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EXPORT TRADE CONDITIONS

We give elsewhere in this issue some figures which present in a forcible manner the growth of American manufacturing exports. So far as electrical applications go, they constitute a large proportion of the increase of the last five years, a fact which can be ascertained more specifically from our weekly returns of electrical shipments out of the port of New York.

There are, of course, fluctuations in such a trade in machinery, although the main movement is steadily forward. For example, during 1899 and the first half of 1900, the machine-tool makers of the West were extremely busy, the greater portion of their trade—with which the motor trade is closely allied—coming from Europe. They got so far behind in filling their orders that the European dealers found it impossible to obtain machines sooner than six to twelve months after they placed the orders. Realizing the necessity of having machines to sell, and seeing no relief from these vexatious delays in sight, most of the aforesaid European dealers placed orders for machine-tools sufficient to meet their wants for a year. This, of course, still further inflated the condition of the machine-tool market here. A drop in the price of raw material in this country led the European buyer to expect some reduction in the price of the finished tool; and they stopped placing further orders.

Practically all the orders placed the beginning of this year, and the end of 1899, have been filled; the dealers in Europe have large stocks on hand, and anticipating a possible reduction in price have not been placing orders during this summer. The result was a serious falling off in the volume of business being done by Western machine-tool builders. Doubtless the same conditions have existed also in the East. July, August and September were unusually dull months, but nearly all the machine-tool men now report a decided improvement during October, which, of course, is a healthy indication for the coming winter's business. Many of them state that the orders they received during August exceeded all the orders received during the preceding three months, and all expect a steady increase in domestic orders after election. Several European buyers are in this country now placing orders.

This brief narration of facts has for it the point that booms are never desirable and that even the best season of trade must have its reaction. There is the further point, however, that our manufacturers must remain in touch with foreign consumers all the time.

DISTRICT MESSENGERS.

The district messenger system in New York City is about to be supplemented by a telephone service, enabling people to tell what they want. It would be a good thing if they were sometimes, or always, compelled to state what the messenger is to do. The youths are exposed to temptation and evil of more than one kind in the errands they run, and need in this respect quite as much help and protection as the factory girls of Paterson. Only last week the New York newspapers made note of a divorce case in which a messenger boy was employed to secure evidence and gain admission to an apartment. It was not a cheerful experience. "I was knocked into a corner as soon as I entered the room," testified the boy, and probably he could not well have expected any other hospitality. But such incidents are an outrage against the boys and against a useful service.

THE AUTOMOBILE SHOW.

The preparations made for the show at Madison Square Garden, of automobiles, by the Automobile Club of America, promise an interesting and successful week. This show, and the one at the Grand Central Palace following horse show week, should furnish a good test of popular interest in the subject, and supply an opportunity for gauging the progress of the past year. At Chicago recently the automobile show was accompanied by racing contests; these will not, however, be possible in New York, but there will be a number of other useful competitions next week at the Garden in which the public will doubtless find amusement and instruction.

THE GREAT EXPLOSION.

At midday, on Oct. 29, in New York City, a terrific explosion occurred in a chemical store in the down-town district, destroying the whole neighborhood and scattering death and ruin in every direction. The drug firm on whose premises the fire occurred, had had previous fires, due to the spontaneous combustion of alcohol, etc., and the present fearful disaster is attributed to kindred causes. It is therefore most amazing to see the *Evening Telegram* print in the body of its story of the fire an elaborate article intimating that "faulty insulation is the principal cause of the year's fires," and thus insinuating that this catastrophe is due to the same origin. To begin with, the assertion as to insulation is grossly untrue. Electricity is more than ever the safest means to-day of furnishing light, heat and power, and the returns show that to be the case. In the second place, the fire in this instance began at the noon lunch hour, when the sun was shining brightly, and probably no lamps or motors were in use. A ranker improbability than that suggested by the *Evening Telegram* it would be hard to conceive. Why, then, the suggestion? We trust that the firm carrying such masses of explosive chemicals on its premises will be treated with all the rigors of the law, and meantime we denounce as a scandal and an abomination any endeavor to divert investigation from its obvious course.

The New York *World* shows common sense in the following: "Even if it could be proved, as it has not been, that the fire and subsequent explosion in the Tarrant Building had its origin in the faulty insulation of an electric wire, that would not fix the responsiblity for the disaster on the careless use of electricity. The electric spark can be held responsible only for the fire, which might have been caused by a match or a lamp or any one of a dozen common causes. The great Chicago fire was caused by a kick from an unruly cow." The *World* goes on to suggest that as to electricity, the rules of the underwriters are excellent, and should be supported by the city authorities. We beg to state that the underwriters are supported by the city's electrical officials and by every other electrical engineer in good standing also. Of course, we all want good insulation used.

INDEPENDENT TELEPHONY.

We should not be doing our duty did we fail to make careful note of the remarkable development in the telephonic field; and such an issue as the present serves to emphasize the news given regularly from week to week in our pages in regard to that branch. The number of exchanges is now over 4000, many of them very small and some unnecessary, but throughout the field there is rapid growth. While the Bell organization is alert and progressive, it is equally to be seen that the independents have already risen to a commanding position and are solidifying it daily by better work. As to general advances and the outlook for the season, the news data we give this week, with more to follow, from several hundred local companies will prove of great interest. It will probably surprise many people. But the notes of technical advance will be to many of even greater importance.

The men most interested in the welfare of the independent telephone movement have long realized that only methods of construction, maintenance and operation could prove successful that were equal or superior to those of the older, experienced and strongly intrenched companies. The independent movement began in small towns and hamlets which had unwisely been left without telephone facilities of any kind. For some time it struck feeble roots there, and the difficulties encountered in large cities proved too much for its early strength. Times have changed. Some of the new independent exchanges are remarkable instances of liberal expenditure and good engineering. Our pages this week give ample illustration of that fact. The creation of such fine exchanges evidences the belief of capital in the profitableness of the work and in the popular support that will be given. Moreover, while not long ago talent outside the old telephone ranks was scarce, it is evident that men of a high degree of ability are coming forward among the independents to equip and manage their exchanges. This is a fact of the first magnitude and its influence on the future of the art cannot fail to be enormous. When we consider the marvelous network of patents covering telephony under the Bell regime, it is, indeed, little short of extraordinary that these modern systems can be built up outside it; but there they are.

That the telephone is a natural monopoly, from inherent conditions, is an article of electrical faith to which subscription has been universal. But it was never more vigorously disputed than to-day. With large and successful independent exchanges in such cities as Pittsburg, Baltimore, Cleveland, Columbus, St. Louis, Indianapolis, Grand Rapids, Muskegon and other places—with more to come—the fight around this tenet has, indeed, waxed hot. The developments and history of the next few years in telephony must necessarily be tremendously interesting from an industrial as well as a technical standpoint.

MEASURED TELEPHONE SERVICE.

Many things point to a great extension of measured and prepayment telephone service the next few years. In fact, the extension has already begun, but telephone engineers are at present rather feeling their way as to the best system of measurement or prepayment to adopt. As the chief engineer of one of the largest companies said, in substance, recently, the measured service seems to be the coming thing, but now that this particular branch of the telephone art is so young, it would be a pity were we to saddle ourselves with some system or apparatus which carried with it a train of unnecessary engineering evils, as we have done sometimes in the past. There was no good reason, for example, when the first exchanges were installed that each subscriber should be obliged to have a magneto-generator in his instrument and turn a crank to do his calling, but that is the way it was done, simply because the first private line instruments were necessarily so equipped. It has taken us years to get over that mistake and its consequences. We must be very careful not to make a similar blunder in the plan of meter and prepayment service we adopt, for it is going to be an important and radical change from present practice, and the change must be made right. So far our telephonic friend.

These remarks only go to show the importance of the movement, and prove that serious consideration is being given to it by the largest companies in the field. The superiority of charging by meter over flat-rate contracts has long been admitted in the electric light field, and now it looks as if our telephone friends were coming to the same conclusion. It certainly is a more logical way to do business to charge for services actually rendered than to charge for the services

supposed to be rendered. The flat-rate method of charging for telephone service has been declared by some as being equivalent to the issuance of a railroad ticket good for a man, his family and all who could represent themselves as being his family. The advantages of measured service and prepayment systems from a theoretical point of view are too decided to admit of argument. On the contrary, experience has demonstrated that both telephone companies and public take kindly to the idea.

The real reason why measured service has not come into use sooner has been the lack of satisfactory systems of measuring and prepayment, but much has been done along that line, and much more will be done the coming two years. Our pages give evidence of efforts to accomplish the desired result. At the same time there comes from Chicago the news that the Chicago Telephone Company is now putting in a large number of automatic pay station telephones at which a rate of only 5 cents a message will be charged, or half that formerly charged at the regular public telephones. The service, to be sure, will not be equal to that at the regular 10-cent pay station, the 5-cent message telephone being on a ten-party line, but it will result in a large increase in the number of subscribers and telephones in semi-public places such as flat buildings and stores, as well as in small offices. The prepayment plan appeals to many small private users who are troubled with sponging neighbors and to locations where joint use by several offices is desirable. The plan has been tried with success in some cities smaller than Chicago. The measured and prepayment plans are necessarily more cumbersome than those of unlimited service, but this objection is being minimized as time goes on.

CONCERNING UNIFORMITY OF EQUIPMENT.

A matter akin to standardization, but relating to the individual rather than to general practice, is the always troublesome question of interchangeable equipment of stations. It is a pretty big question, and for convenience of consideration one may divide it into two, each too large for comfort—viz., uniformity of service, and uniformity of apparatus. The first turns up to confront every new enterprise in electric lighting or power in the form of peremptory necessity for a decision on the kind of service to be furnished. Is the plant in hand going to distribute by direct or by alternating currents or by both, and what kind of motor and arc lighting service is to be attempted? Now, the early Edison plants were strictly consistent—they confined themselves to incandescent lighting and to motors, and later arc lighting service off the same mains. As time went on conditions changed, and it is no uncommon thing to find the same station operating a three-wire system, an alternating system, a 500-volt direct current motor system and both full and half arcs; five kinds of apparatus in a single station. Now, in working above a certain scale there is comparatively little difficulty with this sort of thing, but it is in the medium-sized stations that this complication is most frequently found. The plant will usually have been started as a three-wire system to which arcs, a motor circuit and finally an alternating system have been added. The condition as it stands involves operating small generators, each with adequate reserve and with a correspondingly large variety of spare parts and supplies to throw the store-room into confusion. Is there any balm in Gilead for the superintendent of such a hodge-podge—any hope for relief from his troubles? How many kinds of service must one small station give and how may the necessities of the case be made less burdensome? These are, at best, difficult questions.

In the first place, let us look squarely at the conditions. The first annoyance is the arc lighting. One can do commercial arc lighting beautifully off a three-wire system, at some loss of energy, but cannot in the same way handle the street lighting. On the other hand, while a modern alternating system can take care most successfully of incandescents and of street arc lighting, commercial alternating arcs are only slowly making their way into favor on account of the slight noise that is at present generally characteristic of them. Arc machines will, of course, do the work, but if half-arcs (so-called) are used for street lighting, separate circuits and machines are generally called for on the commercial work on account of the bluish tinge of the enclosed arc when worked with small ampereage. Motors can now be operated with equal facility off direct current and polyphase alternating circuits, so that the motor question settles itself easily. Evidently then, the first thing for a station to get rid of is its special power circuit, for it is generally needless in small and medium-sized plants. But the arc lighting is the rub. Perhaps improvement in the alternating arcs will bring relief, for they now only just meet the requirements by a narrow margin. Suppress or muffle the hum, and a great stride will have been taken. It is, of course, well known that in watts per candle the alternating arc compares somewhat unfavorably with the direct current arc, but all questions of distribution of light aside, the results from the alternating arc are as good as those from a direct current arc taking the same actual watts and worked off a 110 or 120-volt circuit. The alternating arc loses in intrinsic efficiency, but the direct current arc must be taken in connection with the energy wasted in its resistance. A careful working up of the foreign practice of arranging lamps to work in series on constant potential in such wise as to utilize most of the energy may tend to emphasize the advantage inherent in the direct current arc. The present tendency toward working three-wire systems at 220 volts or thereabouts on a side is another feature of the case. So far as incandescents and motor service go, such a sytem can give the ordinary alternating system a very hard rub in places of moderate area. But while it is very easy to get an efficient 24 or 32-cp lamp for 220 volts, a 16-cp lamp is not so easy, and 8 or 10-cp lamps involve great difficulties. What does it profit a man to distribute at 440 volts if he has to furnish energy for 4 or 4.5-watt lamps and his customer is aware of the fact? Also, a 440-volt three-wire system has no easy job in arranging an arc circuit at constant potential.

So, to be frank, the station manager finds himself just at present between the devil and the deep sea. If he has already both direct and modern alternating systems he can generally get rid of an additional motor system, and can, if he likes, get rid of his arc machines by using alternating arcs on the street circuits and working the commercial arcs at constant potential—at the cost of some additional energy. If the Nernst lamp should be brought into good commercial shape, it will do much toward smoothing out the constant potential arc situation, which certainly needs the amelioration. Within a moderate area, a 440-volt three-wire system plus an arc system can be made to meet most of the requirements, save for the rather low efficiency of the lamps, while a modern alternating system will fill the bill, save for need of improvements in alternating arcs for indoor service. We know of no direction in which a moderate degree of improvement would produce a greater effect upon the art than in the line of constant potential alternating arcs, or in the development of something to replace them. Given this particular improvement, and there would be no need of more than one class of apparatus in any plant of moderate size. But at present the art has not quite reached the stage where a plant now running several classes of service can afford to make so radical a change, unless one class is already tending to push the other out of existence in the natural course of evolution. The day, however, of a large and variegated assortment of apparatus has gone by, and in the future station equipments must be reasonably simple.

Five-Cent Telephone Service in Chicago.

Great interest in telephone circles was aroused in Chicago last week by the statement of the Chicago (Bell) Telephone Company that it was ready at once to install public and private telephones on a ten-party line system prepayment plan with a price per call of five cents. The price at all automatic public telephone pay stations in that city has heretofore been ten cents. The new service will not replace the old ten-cent pay stations which are on single lines and free from the interference of a party line service, but will be a distinct addition to the classes of service given by the company. These five-cent pay station telephones will be put in any place of business which will guarantee a monthly income from the telephone equal to two calls or ten cents a day, while residence and flat building telephones will be put in upon a guarantee of five cents per day income. The plan is one which on the face of it would bid fair to be immensely popular because of the large number of small users who will put in telephones on this basis. In fact, it was the usual thing among business men the day following the announcement to hear the remark, "Well, if that report is true I'm going to have a telephone in my house." General Manager Hibbard when seen by the writer was enthusiastic over the new plan and the way it is taking with the Chicago public. Fifty telephones of this kind were put in on the north side the day the announcement was made, and it now seems to be only a question of how fast the factory and construction department can put instruments into service. The new service has been contemplated for a long time, but nothing has been said about it in public until everything was ready to go ahead with the work rapidly and a satisfactory prepayment instrument was developed.

The five-cent automatic telephone service was originated by President Sabin, of the Pacific States Telephone Companies, and has proved a tremendous success in the large cities in that company's territory. In San Francisco, for example, with about 350,000 population the exchange has increased from 4400 to 20,400 subscribers in a short time due mainly to the five-cent prepayment service. Mr. Hibbard expects to see the Chicago exchange reach the 100,000 mark, or an increase of 75,000 subscribers, as a result of the new move, and present indications would confirm this. The company prepared for this work when building its recent new exchanges, and manufacturing facilities are such that 100 telephones a day can be installed. The instruments of the new service will be on the common central battery system, ten on each line. The calling circuits will be connected five between one side of the line and ground, and five between the other side of the line and ground, while the talking circuits when in use will be bridged directly across the line. The subscribers whose call circuits are on one side of the line will have call numbers designated as red, and those on the other side white, and in calling the operator will ring on the red or white side from one to five times, according to the number of the subscriber, four rings calling up number four, etc.

The slot machine used on these telephones is one devised by several engineers connected with the Chicago Telephone Company. It is placed just above the transmitter in an iron box. In calling, the subscriber first listens and determines whether the line is busy. If not he deposits his nickel and gives central the desired number. The operator simply makes the connection and goes on about her work. If the subscriber cannot get the party called for the operator closes a 110-volt circuit which throws a trip magnet giving back the nickel to the calling subscriber. If she does not do this, the nickel is retained in the box. The introduction of this service in Chicago has been retarded more by the want of a satisfactory slot machine than by anything else. This service is not new enough so that the company feels uncertain as to the outcome, in view of its success on the Pacific Slope; but the results in such a large city as Chicago are worth watching with interest.

The New York Sound Money Parade.

The interest taken generally by New York electrical concerns in the electrical division of the Sound Money Parade on Nov. 3 has grown perceptibly as the event approaches. The actual enrollments of paraders numbered 4200 on Wednesday, when over $2,500 had been subscribed for the expenses of music, banners, badges, postage, stationery, etc. The Electrical Industries Association, with Mr. H. L. Shippy as marshal, is to muster in Dey Street, with its right resting on Broadway, and it is timed to get started by 3:25 p. m., with six bands of music. The Western Electric, Crocker-Wheeler and Sprague sections have already begun drilling for the affair, and the miscellaneous engineers, supply houses, cable factories, contractors, etc., are also planning to march under proper leadership, with due discipline. Mr. Shippy has been giving considerable care and thought to the many duties of his position, and expects to turn out one of the finest looking divisions in the whole line. We have been requested to convey his invitation to all who are in sympathy to join and report at 39 Cortlandt Street, Room 20. On Saturday, headquarters will be at 5 and 7 Dey Street, where all regalia will be given out at 2:30 p. m.

Securing Stock Quotations Surreptitiously.

The mystery surrounding the manner in which the outside brokers and commission men were able to secure quotations of the Chicago Board of Trade from Aug. 1 to Oct. 10 was dispelled last week when the testimony of Chicago electricians and telegraph operators was filed in the U. S. court. The secret was revealed by Oscar M. Stone in an examination conducted before Commissioner Harper in Chicago. In brief, it is to the effect that the quotations were secured by a system of messengers, who went to various blackboards and tickers and got the quotations. Then they hurried to a convenient telephone or else to a place where signaling could be done. Then an operator in a room opposite a Lasalle Street broker's office, with the aid of a field glass, read off the quotations as fast as they were posted to an operator presiding at a telegraph instrument. In this way the Chicago and other quotations were furnished to various customers in Chicago and outside cities. Mr. Stone had two offices, one on the third floor and one on the fifth floor of the building where he was situated. The wires ran from the building to Moody & Company's, across the street in a pipe underground, and then for the rest of the way to other offices over the roofs of buildings. These were old abandoned wires that were not used by the telephone company. He had three telephones in his offices, and they were in use almost constantly during these hours, and six men were employed to get the quotations.

Mr. Stone refused to reveal his system of signals. They were the product of his brain, he said, and valuable. The signals were worked by men in the alleys by a combination of the points of the compass. The system did not work well on fractions.

Presidency of the Bell Telephone.

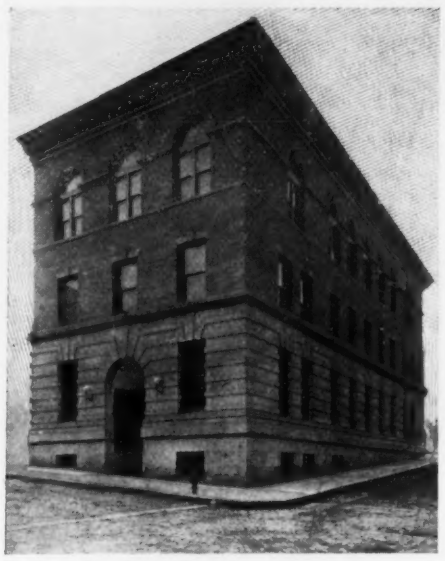
There is naturally considerable discussion as to the presidency of the American Telephone & Telegraph Company, and if persistent rumors are to be believed an incumbent has already been selected. The following is from the Boston *Journal:* "It may be said on the best of authority that the directors of the American Telephone & Telegraph Company have under consideration as the successor to President Hudson, C. F. Cutler, president of the New York Telephone Company; John I. Sabin, president of the Pacific Coast Telephone Company, whose recent presence in Boston has, it is intimated, had to do with this matter; Charles J. Glidden, president of the Erie Telegraph & Telephone Company, and Vice-President and General Manager E. J. Hall, of the Long Distance Company. All of these gentlemen have had a long experience in the telephone business, and any one of them could fill the position of chief executive officer of the American Company in a most acceptable manner. Those who are in a position to be informed as to the probable action of the directors intimate very strongly that Mr. Cutler is the man likely to be chosen for the place. The directors do not hold a regular meeting for several weeks, or until about the middle of next month, although, of course, it is possible that the choice may be made at a special meeting held in the meantime." Mr. Cutler said when interviewed that he knew nothing of the plan referred to in the foregoing despatch.

Distribution of Population.

The recent census returns for Connecticut show that the drift of population from the rural districts to the cities has received a check, and that the reverse conditions have set in. It is suggested that the cross-country trolley lines are largely instrumental in bringing about this distribution of population. The increase of rural population is especially marked in those counties of the State which contain several cities. The total population of the United States is 76,295,220.

The Independent Telephone System at Pittsburg, Pa., of the Pittsburg & Allegheny Telephone Company.

BY KEMPSTER B. MILLER.



ONE of the largest enterprises in the independent telephone field in the United States has just been brought to a state of practical completion in the city of Pittsburg and the adjoining boroughs. The Pittsburg & Allegheny Telephone Company has practically finished the installation of one large exchange and several branch offices, having a total capacity of over 7000 lines with an ultimate capacity of considerably over 16,000 lines.

The main exchange is located in a large fireproof stone building built especially for the purpose, at the corner of Seventh Avenue and Fountain Street, and includes all the facilities of a modern up-to-date office building. Special thought has been given in its layout to the requirements of a telephone exchange. The building is 100 ft. long by about 45 ft. wide, with light on all four sides. The entire third floor is used for the exchange and its accessory apparatus, while suitable retiring rooms and offices are provided on the floor below.

The switchboard and all central office apparatus were furnished by the Kellogg Switchboard & Supply Company, of Chicago. It is designed for use on the central battery plan, and is equipped with all the latest features in the way of automatic calling and of supervisory signals. The present capacity of this exchange is 4080 subscribers' lines, the full equipment for this number of lines being now in place. Provision is made and space left in the operating room for an ultimate capacity of 5400 lines, which extra capacity may be added as service demands.

The main board is shown in Fig. 1, and consists of 19 sections of multiple switchboard, of which 17 are for local subscribers and two for incoming trunk lines. Each of the 17 subscribers' sections has a capacity for 300 answering jacks and drops, as well as for 5400 multiple jacks. At present, however, only 240 answering jacks are provided on each section, so that during the busiest portion of the day when three operators are seated at each section, the calls of 80 subscribers will be allotted to each operator. Each operator's position, of

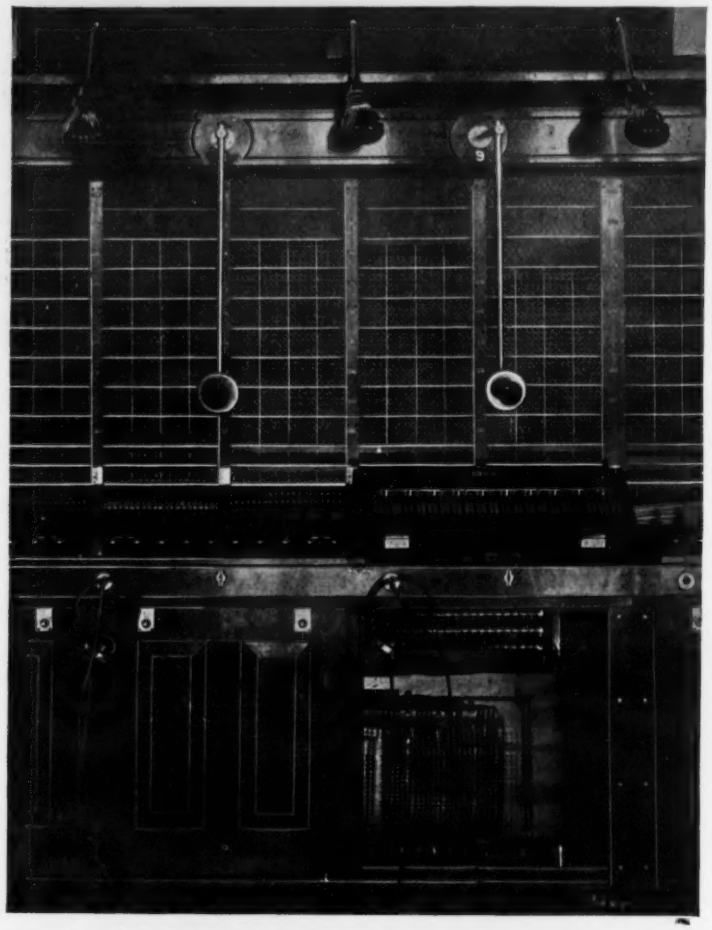


FIG. 2.—FRONT VIEW OF ONE SECTION WITH ONE SUB-PANEL REMOVED AND ONE KEY SHELF RAISED.

which there are three to each section, is provided with ten pairs of cords and plugs, complete with ringing and listenings keys and two supervisory lamps for each pair. The framework of the switchboard is of structural iron, firmly rivetted and bolted together. The switchboard legs are 43 ins. high, and rest on the true floor of the exchange. Above this floor is placed a false floor 17 ins. high, so that the height

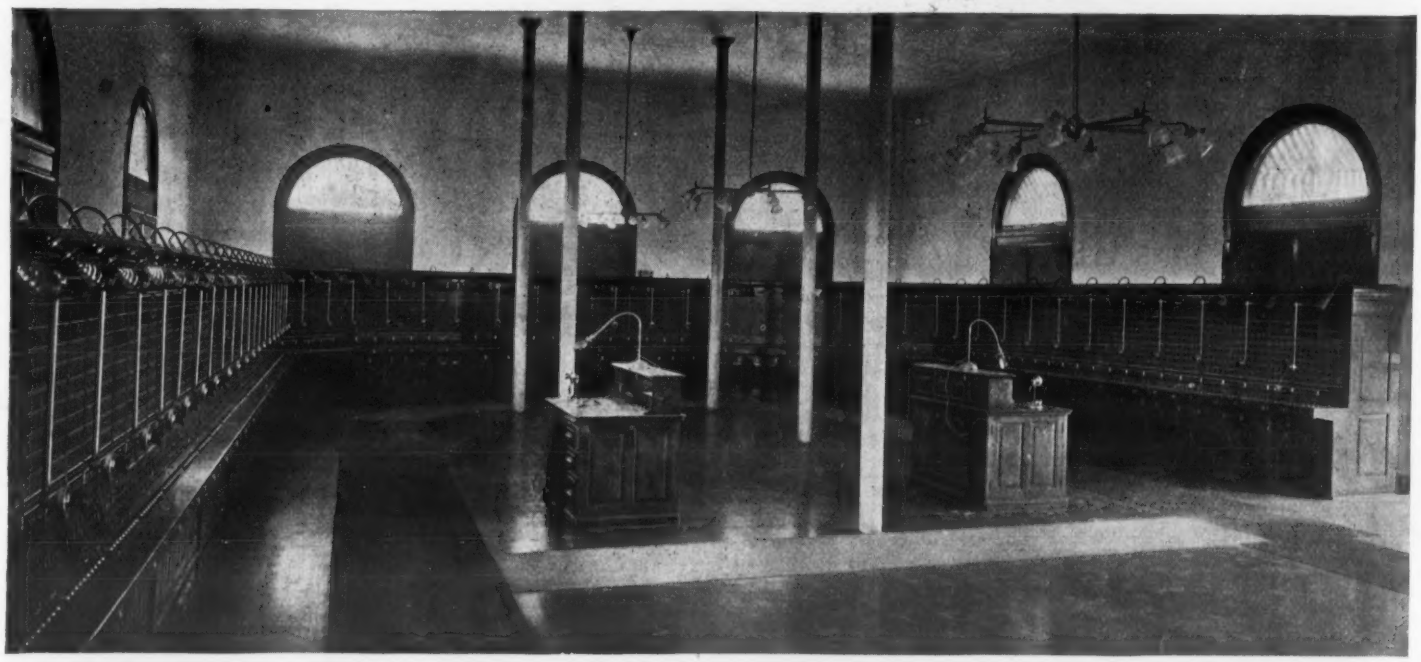


FIG. 1.—INTERIOR OF MAIN EXCHANGE.

of the key shelf above the false floor is approximately 27 ins. This arrangement allows the use of a sufficiently long switchboard cord without the necessity of being unduly high above the operating floor. On the back of the legs of each section are provided connecting racks to which all of the local wiring of the section, that is, the wiring

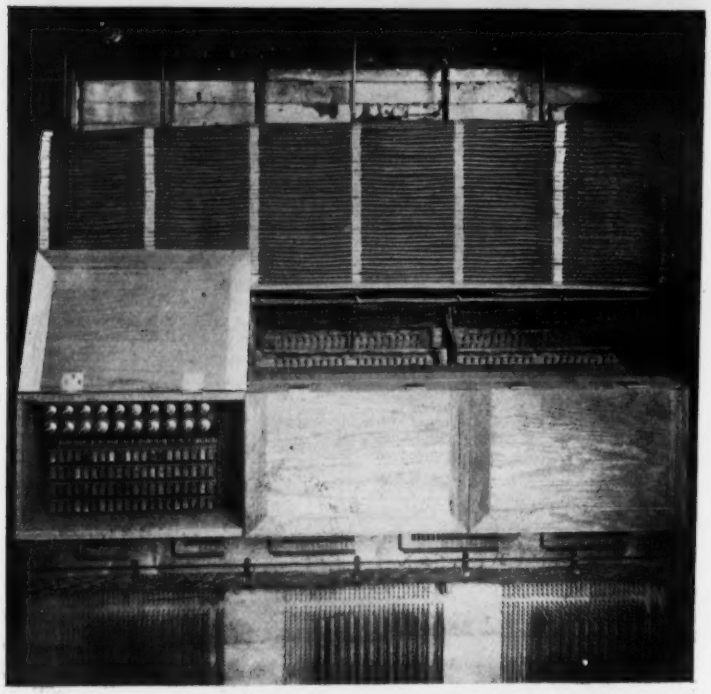


FIG. 3.—REAR VIEW OF ONE SECTION WITH ONE RELAY CASE OPENED.

from the answering jacks, drops, key shelves, operators' circuits, etc., is led. A better idea of the appearance of the front of the board in detail may be had from Fig. 2, which shows slightly more than one section of the switchboard with one key shelf and one of the sub-panels beneath, opened for inspection. The removal of the sub-panel shows quite clearly the inside of the connecting rack with the various cables leading from the answering jacks and drops down to it. All cabling to the inside of the incoming rack on each section was done in the factory.

In Fig. 3 is shown a rear view of one of the sections after its installation was completed. At the extreme bottom of this figure the connecting rack with the cables leading from the distributing board are quite clearly shown. Immediately above this are shown the relay cases, one of which is opened, showing 80 line cut-off relays in its lower portion and 20 supervisory relays in its upper portion, these relays being all mounted on iron strips secured directly to the iron legs of the switchboard.

Immediately above the relay cases are shown the cord racks and just above them the rear view of answering jacks and signals with their wiring. In the upper portion of the figure are shown the multiple cables connecting the multiple jacks in each section throughout the board. These multiple cables are, in each case, of 21 twisted pairs of tin-covered copper wire with an insulation of silk and another of cotton, the cotton being colored distinctively according to a regular code so as to secure the proper selection of wires. These cables are each covered with several layers of paper and with an outside braid of cotton saturated in beeswax. The multiple cables are all formed by the manufacturer and soldered to the spring jacks before leaving the factory, and are then laid up in the switchboard after all sections are in place on the floor. This figure (3) gives an excellent example of one portion of modern telephone work that is rarely seen or appreciated by the public, and the neatness with which the work is done and the evident system with which it is all laid out and executed, is an evidence of the substantiality and excellence of the plant of this enterprising Pittsburg company.

In Fig. 4 another view of the rear of the switchboard is shown, the enclosing panels being entirely removed from the back of the board, as are also the relay protector cases. This view was taken with special reference to illustrating the multiple cable of the exchange, and an inspection of the right-hand portion of this figure will show the method by which the various wires are led from their respective cables to the spring jack terminals.

The frieze boards, key shelves and trimmings on the front of the switchboard are of seasoned mahogany, the key shelf being made five-ply to prevent its warping. The jacks and drops are mounted on

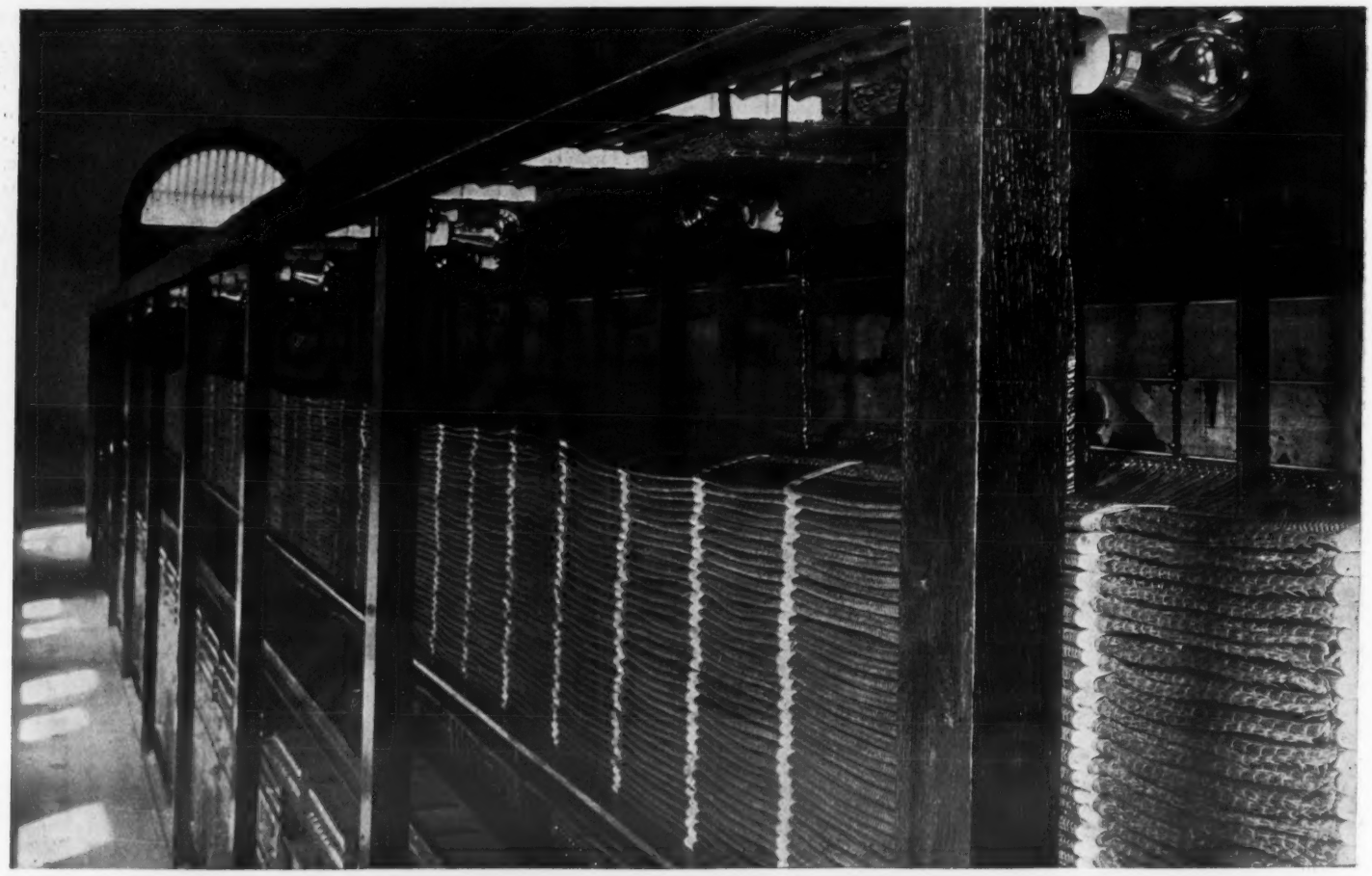


FIG. 4.—REAR VIEW OF A PORTION OF SWITCHBOARD, SHOWING MULTIPLE CABLING.

pins projecting from the rear of stile strips and each screwed in place by a hexagonal nut at each end. The front of the stile strips between the jacks is covered by black ebonized finishing stiles, which latter bear the distinctive numbers for the drops and jacks. Each bank of 100 jacks is supported by a central white holly strip one-eighth-inch in thickness, and all blank panels are filled with ebonized blanks, so that the entire front of the jack and drop space of the board is of a black color, relieved only by the white designating lines and figures and by the small brass test rings of each jack, which may be seen from the front. The jacks are mounted on half-inch centres, both vertically and horizontally, and the drops are also on half-inch centres horizontally so as to be spaced in exact accordance with the answering jacks. The drops, as may be seen quite clearly in Fig. 2, occupy the space immediately above the plug shelf, and immediately above them are the answering jacks and the multiple jacks. The row of jacks between the answering jacks and the multiple jacks are for outgoing trunk lines, which will be referred to more fully later.

The operation of the system, so far as the local subscribers are concerned, is as follows: The subscriber desiring a connection simply removes his receiver from its hook, this act automatically sending a current over one side of the line to operate the signal on one of the

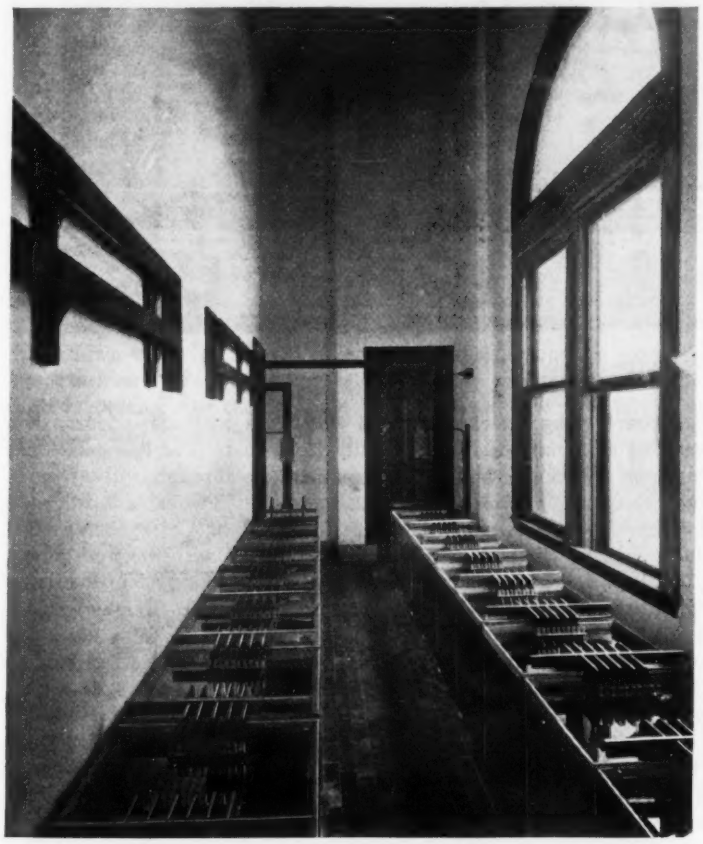


FIG. 5.—BATTERY ROOM.

sections. The operator answers in the ordinary manner by plugging into the corresponding answering jack with one of her answering plugs, and this act operates the line cut-off relay of that line, causing it to disconnect the line from the line signal and to connect it with the jacks from which it has hitherto been disconnected. The operation of the line relay also throws the live side of a storage battery into all of the test rings belonging to that line, so that any other operator will be notified that that line is busy during the connection. Having learned the number of the called subscriber, the other plug of the cord circuit is then inserted into the multiple jack in which the line of the called subscriber terminates. The operator then presses the ringing key which sends a pulsating current over one side of the line of the called subscriber, through his bell to earth. The insertion of this calling plug into the jack also operates the relay of the called subscriber's line, causing it to disconnect that line from the line signal and connect it with the drops.

The supervisory lamp belonging to the plug connected with the subscriber called for is at once lighted upon plugging into the called subscriber's jack, and remains lighted until that subscriber responds, its going out indicating to the operater that he has responded. A corresponding lamp is also connected to the plug inserted in the jack of the calling subscriber. While conversation lasts, both lamps remain out, but as soon as either party hangs up his receiver the corresponding lamp lights up. When both lamps are lighted, the operator knows that the conversation is ended, without breaking into the circuit to inquire, and she immediately pulls out the plugs, breaking the connection. The action of the supervisory lamps is controlled by differentially wound supervisory relays, one of these relays being associated with the circuit of each plug. The circuit conditions are such that the relays are inert as long as the corresponding plug is not in use, and remains inert even while a connection is made until the calling subscriber places his receiver on its hook. These relays are ironclad so as to make their magnetic circuit perfect and also to make them free from cross talk.

One interesting feature in connection with the Kellogg central battery system is that a complete supervisory system is obtained with the use of but two contacts on the plug and two strands to the cord.

In Fig. 5. the battery room of the main exchange is shown. Two batteries of 10 cells each are used, these being chloride accumulators, type G, each cell having 11 plates in lead-lined tanks, with a capacity for 21 plates each. The battery room is well ventilated and has a tile floor on a cement foundation. The bus-bars from the battery may be seen supported on brackets in the left-hand side of the figure, these being of solid copper with a cross section of ½ in. by 3 ins. These batteries furnish current for all talking apparatus and for the operation of the line signals and line and supervisory relays; in fact, for all apparatus in the exchange except for ringing the subscribers, where alternating or pulsating current is required.

The power plant in the main exchange is shown in Fig. 6, and is

FIG. 6.—POWER PLANT.

located in the room immediately adjoining the battery room. The three generators at the left are size 2, double-field, Crocker-Wheeler motor-generators, operating from 210-volt mains and furnishing a current of a suitable voltage for charging the storage cells. The two machines shown in the centre portion of the figure are size 1, single-field ringing machines, furnishing pulsating or alternating current at approximately 50 volts, and operating from the circuit of 210 volts direct. All starting boxes and field rheostats are mounted on the front panels of the enclosing woodwork of the power table, all wiring being concealed within. This affords an extremely convenient method of governing the machines and at the same time utilizes the space in the power room to good advantage. The power switchboard, shown at the right-hand portion of the figure, is of Italian marble, mounted in an angle-iron framework and containing all apparatus other than the starting boxes and rheostats, for the control of the power circuits. This board is provided with two I. T. E. circuit breakers with underload and overload attachment, with four 200-amp, 250-volt, double-pole, double-throw all-copper switches for the charge and discharge circuits, with Weston voltmeters and ammeters and all auxiliary switches and fuses for the various minor circuits.

FIG. 7.—FUSE BOARD AND REPEATING COIL RACK.

In the same room with the power machinery are placed the fuse board and the repeating coil rack. The fuse board forms the distributing point for all circuits leading from the bus-bars of the battery to the repeating coils and other portions of the board. The fuse board is provided with a fuse for each side of each repeating coil circuit. The fuses are all mounted on the front of the marble slab and are connected to ½-in. by 3-in. bus-bars on the back of the board. All

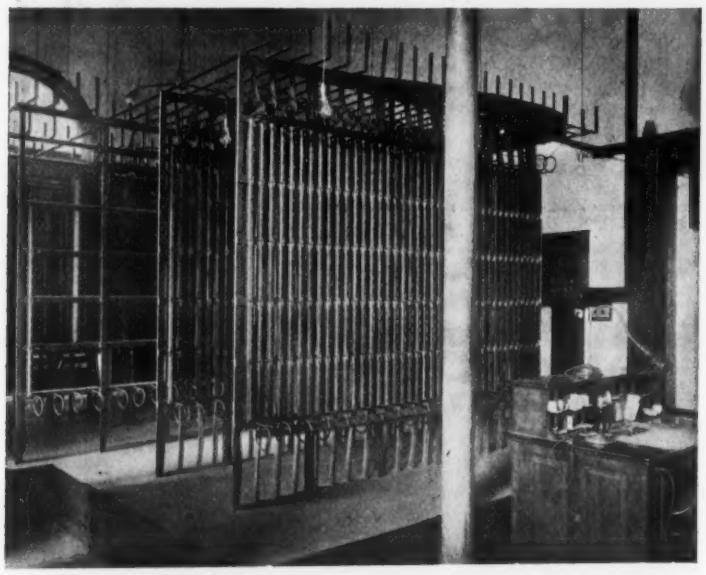


FIG. 8.—DISTRIBUTING AND CABLE TERMINAL ROOM.

bus-bars from the fuse board to the battery are wrapped with heavy cord, afterwards shellacked, and connected to the batteries by burning them into soldering cups at the end of each bus-bar of each battery.

In Fig. 7 are shown the fuse board and the repeating coil rack, the marble face of the fuse board being shown at the extreme right of this figure; the iron framework of both the repeating coil rack and the fuse board being enclosed in panel woodwork with glass doors, thus securing as far as possible, immunity from dust. The line cables are led from the cable vault in the basement up through a large cable shaft to the cable heads on the exchange floor. The cable heads were furnished by the Sterling Electric Company, of Chicago, and each has a capacity of 100 pairs. They are equipped with the well-known Cook heat coil and lightning arrester, and are mounted in five rows on an iron framework provided with suitable cable troughs or running boxes composed of iron lattice work. From the cable heads the circuits are continued by means of 21-pair cables to the line side of the distributing frame. This distributing frame is built of iron, and is shown in Fig. 8. It has a capacity for terminals for 6000 lines and is provided with terminals for 4800 clips on both the switchboard and the line side. The switchboard terminals and the line terminals are arranged in vertical rows for 100 lines each, the rows for the line terminals alternating with the rows of the switchboard terminals. Cross connecting is accomplished on the back of the distributing frame, which is divided into three portions, as shown. Wires from the line terminals are led up or down to large iron rings on the front of the board, through which they are passed to the opposite terminals on the switchboard side, after which they pass down to their respective terminals.

In Fig. 8 the cable heads may also be seen in the rear, and in the upper right-hand portion the 20-pair cables which connect the cables to the line side of the distributing board may be seen. From the switchboard terminals of the distributing frame 20-pair cables lead down under the false floor and through running boxes to the first switchboard section, which in this case is a trunking section. Here the telephone lines terminate in a connecting rack in the rear of this section, while the subscribers' lines and order wires are carried through the two trunk sections to the first subscriber's section. The order wire circuits terminate at the connecting rack of each subscriber's section, and from the rack they are wired directly to the order wire keys, placed at the left hand of the key shelf on each operator's position. These order-wire circuits are, of course, required only for giving instructions concerning a transfer of any connection between the various branch exchanges and the main exchange. The subscribers' lines terminate on a connecting rack on the back of each section, there being, as already stated, 240 lines to each section. From

the inside of the connecting rack the wiring is continued, as already described, to the line cut-off relay, and from thence either to the line signals or to the spring jacks, according to whether the line is idle or not.

Trunking between the branch exchanges and the main exchange is carried on by means of 240 incoming and 200 outgoing trunk lines to and from the main exchange. The incoming trunk lines terminate in jacks at the bottom of the switchboard panel on the first two sections, there being 40 to each operator's position. Each incoming trunk section also contains the full number of multiple jacks, so that the incoming trunk operators may complete any connections called for. Two hundred outgoing trunk lines are provided, 100 of which are multipled throughout the first 8 sections and the other 100 are multipled throughout the remaining 9 sections. By means of these, any call originating in the main exchange may be transferred to any of the branch exchanges.

All lines are underground in the entire business section in the heart of the city, and also in a considerable area in East Liberty, South Side and Allegheny, as well as conduits between these centres. Standard Underground Cable Company's cable is used throughout, this being 200 pairs in most cases, although 25, 50, 75, 100, 125, 150 and 175-pair cable is used as required. The conductors are No. 20 B. & S. gauge, double wrapped with paper for all sizes except the 200-pair, which is single wrapped.

The conduit is of vitrified clay, in 18-in. sections, with a 3½-in. round opening. All manholes are square, of brick, and on concrete foundations. Extra heavy castings are used for manhole covers, these weighing in most cases 2600 lbs. Much of the conduit is laid under the sidewalk on account of peculiar conditions in regard to the repaving of the streets. Where possible, they occur at corners. The longest distance between manholes is 400 ft., though the average is much under this.

Cook pole-top terminals are widely used, distribution being extensively made from a large ring carrying insulators and secured to the pole by iron brackets just below the pole-top.

In down-town districts, underground distribution is used, a wrought-iron pipe carrying the cable from the manhole to the cable vault or basement of the building. All overhead bare wire is No. 12 B. & S. Gauge, hard-drawn copper.

FIG. 9.—PRIVATE BRANCH EXCHANGE BOARD.

In addition to the main exchange, six branch exchanges are either completed or well under way. Of these, the "Bellefield," "South Side," "Lawrenceville" and "Manchester" are of the Kellogg universal type, equipped for common battery throughout, and each has a present equipment of 240 lines, and an ultimate equipment of 1200 lines, with 20 incoming and 20 outgoing trunk lines. The "East End" and "Allegheny" exchanges are of the same type as the main switchboard, i. e., straight multiple with common battery. The "East End" exchange has a present equipment of 800 lines, with an ultimate capacity of 3000, with 60 outgoing and 60 incoming trunks. The "Allegheny" exchange has a present equipment of 1200 lines, and an ultimate capacity of 3000 lines, with 100 outgoing and 100 incoming trunks. The trunking in all these exchanges is handled in practically the same manner as that of the main exchange. The storage batteries at "Bellefield," "South Side," "Lawrenceville," "Manchester" and "East End" are of the American Storage Battery Company's make, there being two batteries of 10 cells each of J4 elements in J7 tanks. At the "Allegheny" exchange, chloride accumulators are used, each consisting of two batteries of F9 cells in F13 tanks.

FIG. 10.—WALL TELEPHONE.

FIG. 11.—DESK TELEPHONE.

Beside the large branch exchanges, the company has installed a number of small private branch exchanges in the principal public buildings, these being provided with trunking systems to and from the main exchange. The type of board used on these small exchanges is shown in Fig. 9. This board is provided with rotary self-restoring signals and equipped for common battery service. The desks are finished in mahogany, so as to make an attractive appearance in any office, no matter how elaborately furnished.

The subscribers' wall telephones were made by the Maryland Telephone Manufacturing Company, of Baltimore, Md. These instruments are made under the Kellogg patents and designs. The wall sets are substantially as shown in Fig. 10. The subscribers' desk sets were manufactured by the Kellogg Company, and are shown in Fig. 11.

The personnel of the company is as follows: Henry A. Parr, president; Sidney Hand Browne, vice-president and treasurer, and George H. Wilson, counsel. Mr. Browne is also chief engineer of this company, as well as of the Maryland Telephone & Telegraph Company, of Baltimore, and it is largely to his intelligent work and untiring efforts that the great exchanges in these two cities have been brought to their present successful existence. Mr. W. H. Crumb is the general superintendent. All the outside construction work of the company was done under the supervision of Mr. John Crowley.

Automobile Motor Wheel.

Placing the motor of an electric vehicle in the wheel is not a new idea. Mr. C. E. Isbills, of Passaic, N. J., has now been granted a patent which relates to the mechanical construction of a wheel generally intended for a vehicle or car, but particularly adapted for use on an automobile, the wheel being so constructed that the motor is within the wheel. The tire of the wheel is slipped upon the field-magnet ring and held between dished webs, which are secured to the magnet-ring, with their circumferential edges projecting for holding the tire and their central portions being formed with bearings for the axle of the automobile, the armature of the motor being fixed to said axle. Handholes are cut in one of the webs and are provided with removable covers, the commutator and brushes being within reach of the handholes within the webs and located between the armature of one of the webs, the collector-rings being located between the armature and the other web and serving to communicate the current from the fixed portions of the automobile to the revolving field-magnets.

The Induction Motor—I.

BY B. A. BEHREND, E. E.

THE following series of essays is an elaboration of some lectures on the induction motor, delivered at the University of Wisconsin. The induction motor has, for the past 10 years, been the object of innumerable publications, of abstruse mathematical theories, and of much unpleasant, though perhaps inevitable, scientific squabbling. To attempt to give a historical and critical survey of the many excellent labors in this field, which have helped to clear and level the road leading to an understanding of the essential conditions upon which a clear insight into the working of the induction motor depends, would far exceed the limits which I have set myself in this article. However, it seems to me but fair to acknowledge my indebtedness to the writings of Galileo Ferraris, Joh. Sahulka, Gisbert Kapp, and André Blondel, who, as pioneers in the early days of polyphase currents, did splendid work by laying a sound and safe foundation for a complete theoretical superstructure. It has been my aim in this article to give a systematic representation of the complex phenomena in the induction motor, while constantly bearing in mind that, as the great physicist, Dr. Ernst Mach, has it, the basis and essence of science is economy of thought. The essence of the theory as here set forth has been previously published by me in short monographs in the *Elektrotechnische Zeitschrift*, Berlin, where they are hardly accessible to the general American reader. This circumstance, the methodical treatment of the subject, and the addition of much experimental material, new to the majority of readers, will, I hope, be considered ample justification for this article. The chapters on the leakage factor are new, and have never before been published.

I.—THE GENERAL ALTERNATING CURRENT TRANSFORMER.

The problem of problems, in the solution of which the electrical engineer is deeply interested, and which underlies all others, is set before us in the form of the alternating current transformer possessing considerable leakage and a relatively large magnetizing current.

A transformer with an open secondary takes from the primary mains just so much current as is necessary to produce a magnetic field which can balance the primary voltage. This current—neglecting for the moment hysteresis and eddy currents—lags behind the primary voltage by a quarter of a phase; hence the work done by this current is zero, and the magnetizing current is therefore a "wattless" current.

If you throw a non-inductive load upon the secondary, that is to say, if the secondary of the transformer be closed through a resistance, then the impedance represented by the action and reaction of the primary and the secondary system of the transformer, is diminished, permitting a larger current to flow. If, for didactic purposes, we make the assumption that the whole magnetizing force of the primary is transmitted without loss into the secondary, and vice versa, then the vector of the primary current must be composed of two vectors, the one representing the magnetizing or wattless current, lagging behind the terminal volts by a quarter of a phase, and the other representing the watt current and being in phase with the terminal volts. Thus the vector of the primary current for any external resistance is determined by the locus of the point A, Fig. 1, which is the straight line $\overline{A\,D}$ parallel with the vector of the impressed e. m. f. The energy consumed by the transformer is given by the equation

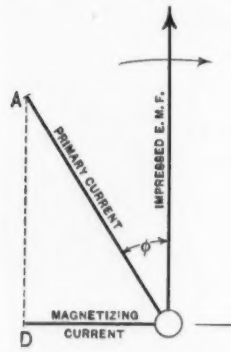


FIG. 1.

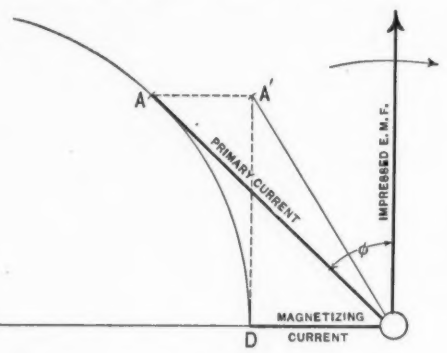


FIG. 2.

$$(1)\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \mathfrak{E} = e \,.\, i \cos\phi$$

in which are

$i \,.\, \cos\phi$ = watt current.
$i \,.\, \sin\phi$ = wattless current.

The introduction of leakage into the transformer changes the diagram as follows: The total number of lines of induction passing through the primary coil must remain constant as long as the terminal voltage remains constant, neglecting for the moment the ohmic resistance of the coil. The magnetomotive force of the main current produces a stray-field proportional to the driving current; this field added vectorially to the main magnetic field, generates the constant magnetic field included by the primary coil. The result of these actions and reactions is that A does no longer move in a straight line, but in a semi-circle described upon the prolongation of $\overline{O\,D}$ (1).

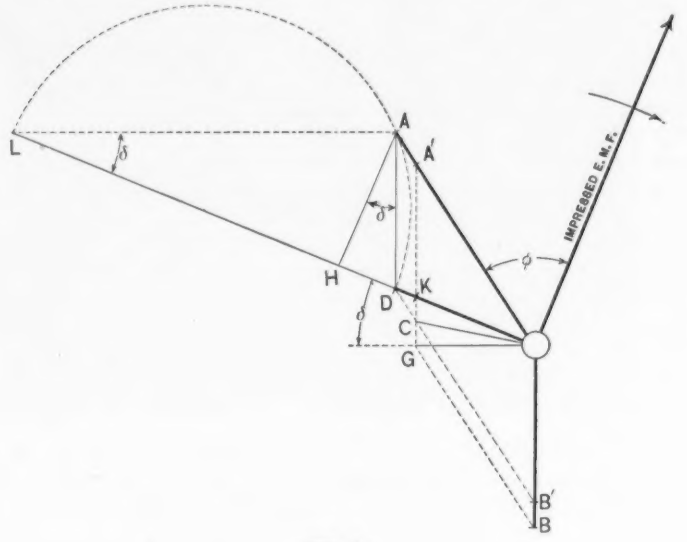


FIG. 3.

It is of extreme importance for us to clearly understand these relations as they form the basis for all further reasoning.

In Fig. 3 $\overline{O\,A}$ is the vector of the magnetomotive force of the primary, or, in other words, the total number of lines of force (not induction) produced by the primary current, and corresponding to the number of ampere-turns. Not all the lines of force which the primary current generates can reach the secondary of the transformer. Let us assume that the amount $\overline{A\,A^1}$ is lost, $\overline{O\,A^1}$ being equal to $v_1 \,.\, \overline{O\,A}$, v_1 being a factor smaller than one and measuring the loss of lines from the primary to the secondary. Let $\overline{O\,B}$ represent the vector of the total number of lines of force of the secondary, and $\overline{O\,B^1} = v_2 \,.\, \overline{O\,B}$ the number of lines that extend into the primary, v_2 being again a coefficient smaller than one, then we see at once that the vector sum of $\overline{O\,A}$ and $\overline{O\,B}$ must be equal to the vector of the magnetomotive force which can produce a magnetic field which just balances the primary voltage. The vector of this magnetomotive force is represented by the line $\overline{O\,D}$.

The lines of force which are common to both primary and secondary, are the effect of the two magnetizing forces $\overline{O\,A^1}$ and $\overline{O\,B^1}$; while the lines of force which pass through the secondary only, can be found as the resultant of $\overline{O\,A^1}$ and $\overline{O\,B}$. This resultant, $\overline{O\,G}$, must be perpendicular to $\overline{O\,B}$, as $\overline{O\,B}$ is produced through the oscillations of $\overline{O\,G}$.

The following list will help to make the diagram more clearly understood:

$\overline{O\,A} = X_1$ is the total magnetizing force of the primary.
$\overline{O\,B} = X_2$ is the total magnetizing force of the secondary.

---

(1) A historical remark may not be out of place here. The present writer worked out the theory here given in the summer of 1895, and sent the paper to the *Elektrotechnische Zeitschrift*, Berlin, where it was published in February, 1896. Meanwhile Mr. A. Heyland, in some letters to the above-named paper, used the same diagram without, however, giving any proof. When Mr. Heyland's letters were published I inserted a note in my MS. referring to them. I have since, whenever I had an opportunity, given Mr. Heyland ample credit for his priority, and I have done it with satisfaction, as I really admired some of his later papers very much. Mr. Steinmetz informed me some time ago that he had found this relation as early as 1893, but that commercial reasons prevented him from publishing.

$\overline{OA^1} = X_1 v_1$, is the magnetizing force of the primary that extends into the secondary.

$\overline{OB^1} = X_2 v_2$, is the magnetizing force of the secondary that extends into the primary.

$\overline{OA} - \overline{OA^1} = X_1 - X_1 v_1$, is the unbalanced magnetomotive force of the primary producing a leakage field.

$\overline{OB} - \overline{OB^1} = X_2 - X_2 v_2$ is the unbalanced magnetomotive force of the secondary producing a leakage field.

$\overline{OD} = X$, is the magnetomotive force which sets up a magnetic field balancing the terminal voltage.

It will readily be seen that, if the drop caused by the ohmic resistance of the primary may be neglected without too much inaccuracy, $\overline{OD} = X$ is constant if the terminal voltage is so. We have, Fig. 3,

$$\angle HAD = \angle HOG = \angle \delta$$

$$sin\ \delta = \frac{\overline{GK}}{\overline{OK}} = \frac{\overline{A'G} - \overline{AK}}{\overline{OK}}$$

$$\overline{A'G} = X_2$$

$$\overline{AK} = \frac{\overline{OA'} \cdot \overline{AD}}{\overline{OA}}$$

$$= \frac{X_1 v_1 \cdot X_2 v_2}{X_1}$$

$$= v_1 v_2 \cdot X_2$$

$$\overline{GK} = \overline{A'G} - \overline{A'K}$$

$$= X_2 - v_1 v_2 \cdot X_2$$

$$= X_2 (1 - v_1 v_2)$$

$$\overline{OK} = \frac{\overline{OD} \cdot \overline{OA'}}{\overline{OA}}$$

$$= \frac{X \cdot v_1 X_1}{X_1}$$

$$= v_1 \cdot X$$

$$\text{Hence, } sin\ \delta = \frac{\overline{GK}}{\overline{OK}} = \frac{X_2 (1 - v_1 v_2)}{v_1 \cdot X},$$

$$\text{or, } sin\ \delta = \frac{X_2 v_2 (1 - v_1 v_2)}{v_1 v_2 \cdot X}.$$

In words, this means that $X_2 v_2$ may be represented as a chord in a semi-circle described upon $\overline{LD}$ as basis, and having a diameter

$$\overline{LD} = X \cdot \frac{v_1 v_2}{1 - v_1 v_2}$$

We call the quotient $\frac{X}{LD}$ the leakage factor σ of the transformer, and have therefore

$$(2) \ldots\ldots\ldots\ldots \sigma = \frac{1 - v_1 v_2}{v_1 v_2} = \frac{1}{v_1 v_2} - 1$$

The leakage coefficient σ is the most important factor in the theory of the alternating current transformer, and a successful design must

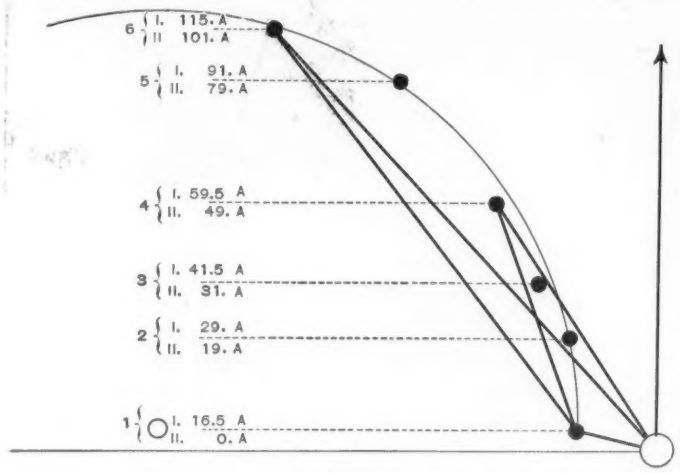


FIG. 4.

endeavor to keep σ as small as possible. The determination of σ will be treated of in a chapter devoted entirely to the leakage factor.

The following table contains the results of a series of measurements as a corroboration of the theory. The data were taken from a three-phase current motor, the armature of which was standing still; the whole apparatus was thus acting as a transformer with considerable leakage. The *field* contained 36 closed slots, 7 conductors in each slot; resistance of each phase 0.045 ohms. The *armature* contained 90 round holes, 3 conductors in each hole; resistance at each phase 0.172 ohms. Number of poles, 6. Frequency, 48 ∼.—

PRIMARY CIRCUIT.			SECONDARY CIRCUIT.		
Volts (each phase.)	Amperes.	Watts.	Volts (each phase.)	Amperes.	Watts (calculated.)
97.5	14.3	1010	94	0	0
110	29	7400	102	16.6	5080
110	41.5	11000	100	31	9030
110	59.5	16400	95	46	13110
110	91	24400	79	80	18960
110	115	28000	70	97	20370

A graphic representation of the experimental data of the table is given in Fig 4.

It will be noticed that the observed points lie very closely on a circle, the diameter of which corresponds to 168 amperes primary current.

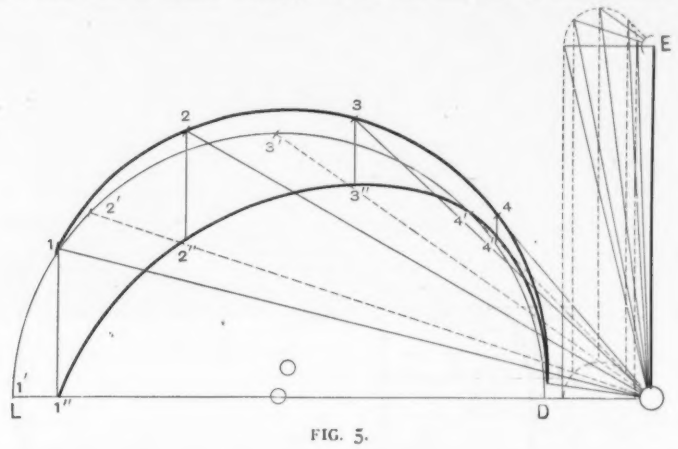


FIG. 5.

Below each point the primary and secondary currents are written, the latter being taken from the diagram. The agreement between them and the observed values in the table may be called satisfactory, especially since we have had to guess as to the real value of v_2.

From our table we can compute the value of v_1. A voltage of 97.5 at the primary would, if there were leakage loss, produce at the secondary a voltage of $(90.3 \div 36.7)\ 97.5 = 104.5$. We observed, however, only 94, hence we have

$$v_1 = \frac{94}{104.5} = 0.90.$$

We should make a great mistake were we to assume that this value would give us a leakage factor σ true to reality, since in our case, where the slots in armature and field are closed, v depends greatly upon the saturation of the thin iron bridges closing the slots. The saturation of these bridges is dependent upon the intensity of the current; beyond a certain intensity v, and therefore σ is practically constant. Assuming v_1 to be equal to v_2, we should get for

$$\sigma = \frac{1}{0.90 \cdot 0.90} - 1 = 0.235, \text{ instead of } \frac{16.5}{168} = 0.098,$$

as follows from the diagram.

It may be advisable to emphasize that in the derivation of the diagram the ohmic resistance of the primary has not been taken into account. As this point is of extreme theoretical and practical importance, we have to dwell on it at some length.

THE INFLUENCE OF THE RESISTANCE OF THE PRIMARY UPON THE DIAGRAM.

The semi-circle $L\ 1'\ 2'\ 3'\ 4'\ D$, Fig. 5, represents the locus of the current for a constant terminal voltage OE, upon the assumption that the primary resistance be negligible. The arc 1 2 3 4 is the locus of the current if we assume that the drop through ohmic resistance in the primary amounts, for point 4′ to 10% of OE. Finally the ordinates of the curve $1''\ 2''\ 3''\ 4''$ represent the amount of watt-component of the current that is available in the secondary circuit. It

would be superfluous here to say anything about the manner in which these curves have been plotted, as everyone familiar with polar diagrams will readily understand it from the lines in the figure.

It is of importance to note that, though the primary resistance was assumed to have a value which exceeds about five times the real value in practice, yet the curves L 1′ 2′ 3′ 4′ D and 1 2 3 4 deviate comparatively little from each other. If $\overline{OD}$ were zero, then they would not deviate at all. In reality, $\overline{OD} \div \overline{LD}$ is almost always considerably smaller than it is in our figure. If, however, $\overline{OD}$ is large in comparison with $\overline{LD}$, and if the primary resistance is considerable, we have to draw a diagram like Fig. 5. This will be the exception and not the rule.

Thus we have learned that the influence of the ohmic resistance upon the locus of the current is, in most practical cases, negligible; but the energy dissipated in the resistance, is in all cases to be taken into account; this can be done by deducting the watt-component corresponding to the ohmic loss from the ordinates of the semi-circle $\overline{LD}$. We thus arrive at a curve similar to 1″ 2″ 3″ 4″.

GENERAL CONCLUSIONS AND SUMMARY.

We are now enabled, with the help of the diagram, to solve any question pertaining to the alternating current transformer. We shall, in a later chapter, discuss or detail in a concrete case the many problems of interest which this diagram permits us to solve; here we shall merely summarize the main conclusions at which we have arrived.

In Fig. 6 $\overline{OA}$ represents the primary current i_1, $\overline{OD}$ the magnetizing current i_0, and $\overline{AD}$ is equal to $v_2\, i_2 \frac{n_2}{n_1}$, in which n_1 and n_2 are the number of turns in the primary and the secondary, respectively.

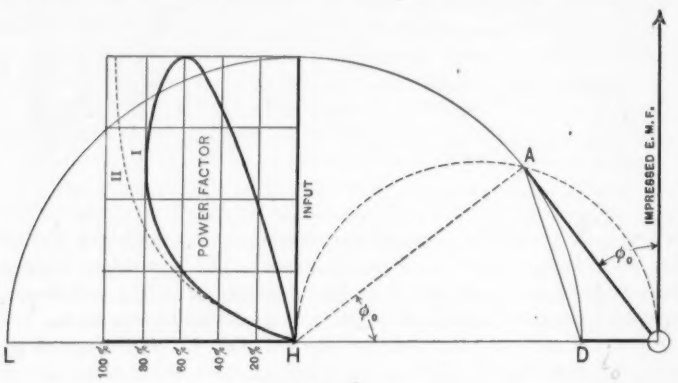


FIG. 6.

The smallest lag ϕ_0 is determined by the intersection of the semi-circle $\overline{LD}$ with the semi-circle HAO, as can be seen at a glance. The cosine of this angle can be expressed as follows. It is

$$\overline{HA} = \overline{HD} = \frac{i_0}{2\sigma}$$

$$cos\ \varphi_0 = \frac{\overline{HA}}{\overline{HO}} = \frac{i_0}{2\sigma\left(i_0 + \frac{i_0}{2\sigma}\right)}$$

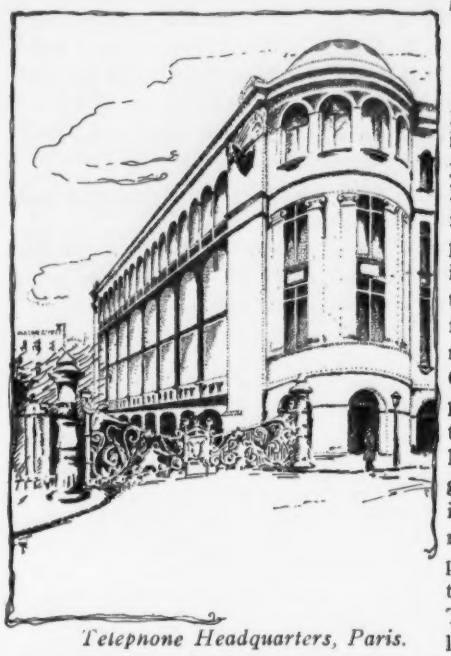
$$cos\ \phi_0 = \frac{1}{2\sigma\left(1 + \frac{1}{2\sigma}\right)}$$

$$(3) \ldots\ldots\ldots\ldots\ldots\ldots cos\ \phi_0 = \frac{1}{2\sigma + 1}$$

This equation enables us to predict the maximum power factor if the leakage coefficient σ is known. I will here premise that the starting current furnishes a value for the determination of the diameter of the semi-circle, while the magnetizing current can always easily be measured. This method of determining the maximum power factor attainable thus recommends itself not only to the designer, but, on account of its simplicity and accuracy, also to the customer.

The full curve I of higher order in Fig. 6, which can easily be constructed, represents the power factor as a function of the power input; the dotted line II shows the power factor for a transformer without any leakage.

Telephony in Paris in the Exposition Year.



Telephone Headquarters, Paris.

THERE have been a great many American telephonists — managers, engineers, experts, etc. — in Paris during the present Exposition year, and naturally they have taken considerable interest in the various aspects of their own art and industry. At the Exposition, outside the provision for telephonic intercommunication made by the Government and the Exposition authorities, attention was directed naturally to the exhibits, in regard to which various items and articles have already appeared in these pages, including one on the Poulsen telegraphone. To most Americans, the last-named device was about the only real telephonic novelty in the Show, but to Europeans, the exhibit of an 18,000 line central energy exchange of the Bell system in the space of the Western Electric Company, has been, it is safe to assert, an equally novel and interesting feature. The central energy system is still virtually unknown in Europe, although this condition will not last much longer, as such exchanges have now been put in operation at Vienna, Munich and Bristol; three are under construction in London, and others are seriously projected for Brussels, Liege, Bucharest, Lausanne, Sunderland, Nottingham and Hull. These will represent a total of not quite 49,000 subscribers. Incidentally, it may be noted that American telephonists who have seen the old Law type of horizontal telephone board disappear from the United States, were surprised to learn from the Exposition that the horizontal variety is still being installed in Enrope in competition with the vertical.

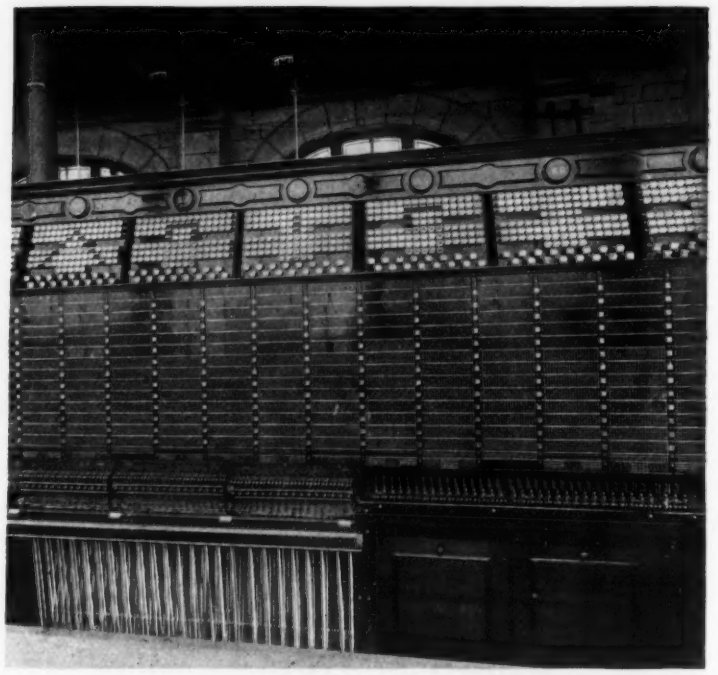


FIG. I.—FRONT VIEW OF TWO SECTIONS OF 9000-LINE BOARD—MAIN EXCHANGE, PARIS.

The telephone service at the Exposition has been given by 82 pay stations, the regulations in regard to which were detailed in the general article on the Exposition in these pages last May. These booths are connected with a "central" on the Exposition grounds, in the Champ de Mars section, near the Avenue Rapp, there being also seven sub-offices at the main Exposition and Vincennes for the postal, telegraphic and telephonic work. The daily number of telephone

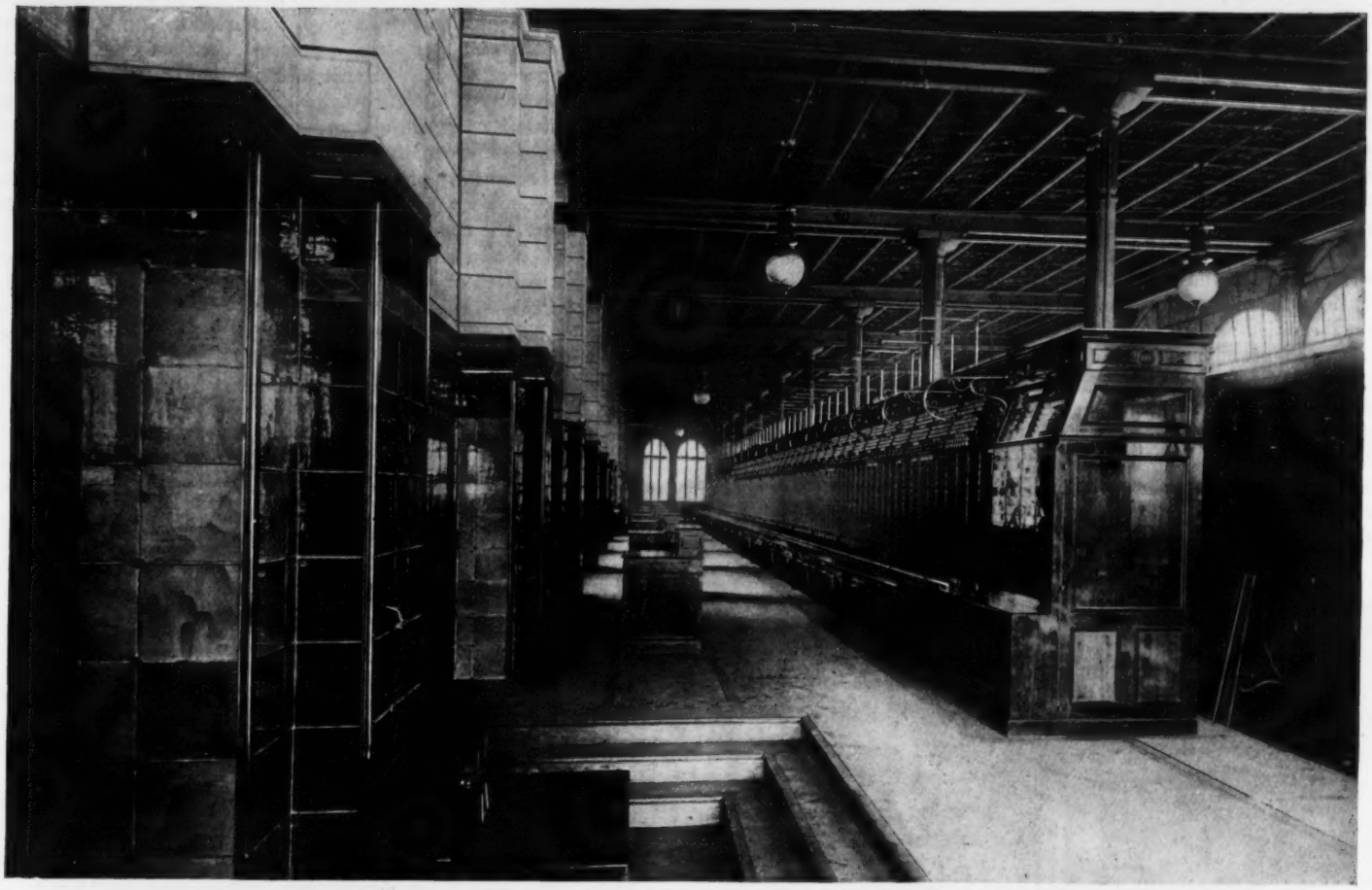


FIG. 2.—9000-LINE BRIDGING BOARD, MAIN EXCHANGE, PARIS—WEST SIDE.

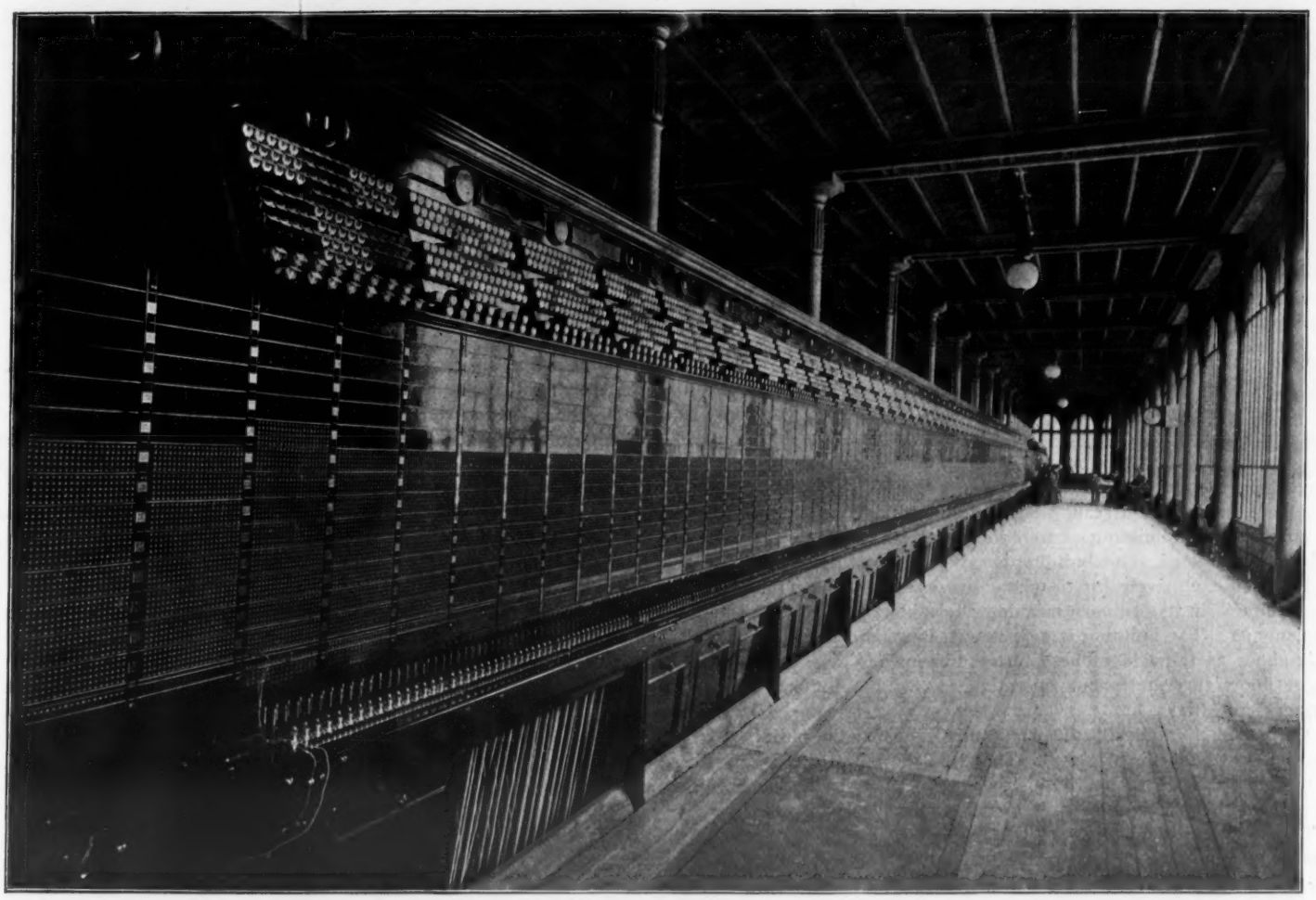
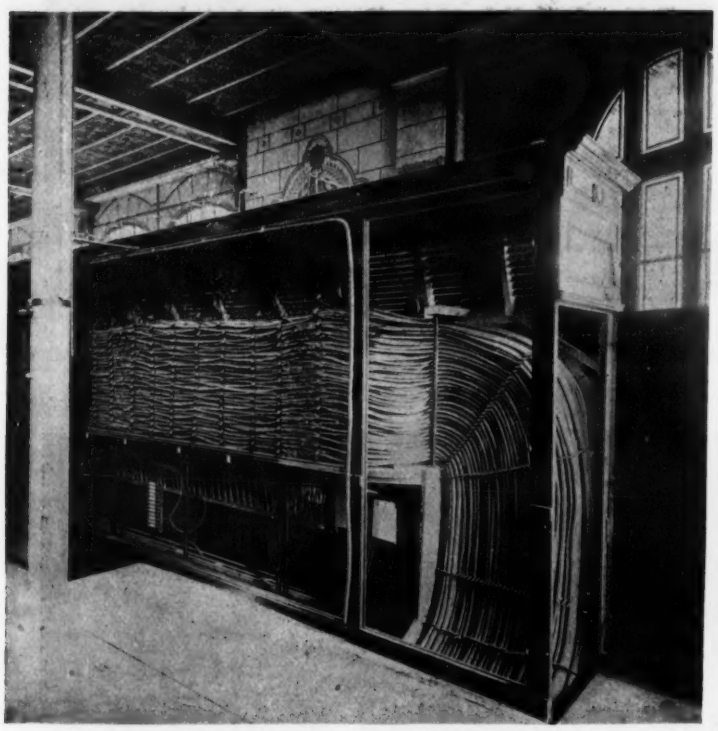


FIG. 3.—9000-LINE BRIDGING BOARD, MAIN EXCHANGE, PARIS—EAST SIDE.

calls originating in the grounds has been between 1500 and 1600. As already noted, through the Western Electric exhibition board, American exhibitors and visitors have had a special service, including Vincennes, which has been of great utility because of its instantaneity where the regular French service had not to form part of the circuit. Owing to the congestion of business on the lines, that being due again to the difficulty in securing transportation in Paris this year, the general telephone service has been extremely slow. The present writer has time and again spent anywhere from 20 to 45 minutes trying to make a connection.

That leads to the Paris central exchange here illustrated, which American visitors have been surprised to find is in reality the largest exchange in the world. In Europe generally, sub-exchanges are rare, the cities being far more compact than those in America, and Paris even at this moment must be regarded as still "within the walls." From these conditions of restricted expansion comes the fact that Paris has so much, and practically all, of its telephone system under one roof.

When the French Government took over the Paris telephone system from the Société Générale des Téléphones some ten years ago a complete reconstruction of the plant was organized on a very liberal scale. The scheme involved the erection of a number of central office buildings to take the place of the numerous small exchanges of the Société which were stowed away in the basements and even in the cellars of some of the oldest buildings in Paris. A site for the main exchange was picked out in the very heart of the city, immediately opposite the General Post Office, situated on the Rue du Louvre. The buildings fronting on an old street, the Rue de Gutenberg, running along the side of the G. P. O. from the Rue de Louvre to the Rue Jean Jacques Rousseau, were demolished, and on the ground a magnificent stone building of four lofty stories, a veritable telephone palace, was erected. This building is called "l'Hôtel des Téléphones," and is used exclusively for telephone purposes, so taking the French word "hôtel" in its ordinary meaning, "telephone palace" is not at all a misnomer. The building is over 200 ft. long, and the main part of it is about 35 ft. wide. These liberal dimensions give on the three upper floors three telephone operating rooms that for spaciousness, airiness and light are not surpassed by any telephone building in the world. Practically the whole north side of the building, facing the Post Office, is of glass, as shown in the initial sketch, and the natural light is, consequently, all that could be desired. The height of each of the principal floors is 16 ft.



FIGS. 4 AND 5.—REAR VIEWS OF 9000-LINE BRIDGING BOARD—MAIN EXCHANGE, PARIS.

The Paris telephone system has always been worked on metallic circuit lines and by means of underground cables. In fact, Paris is the one large city of the world where an overhead wire of any sort is nowhere to be seen. The telephone cables are carried through the main sewers, and the distribution to the subscribers' premises is effected by means of direct underground connections from the sewers to the cellars of the houses. An inspection of the sewers is an indispensable feature of a scientific visit to Paris, but, as many electrical visitors have found this year, it is an experience most trying to one of ordinary constitution and average development of olfactory nerve. The main sewers are usually of egg-shaped section with a ledge at one side. In the vicinity of an exchange the telephone cables are carried in a large iron trough built on the ledge against the side of the tunnel. Where the concentration of cables is not great, the cables are supported on iron brackets or clamps driven into the walls. Dry-core cables are used of 56 and 112 pairs. As the distance from the exchanges increases, the cables are split up, dwindling to single-pair gutta-percha cables that are led through an iron pipe directly into the cellar of the subscriber's premises.

At the main exchange there are concentrated some two hundred cables, which enter the huge cellar underlying the whole building through two large tunnels connecting with different branches of the main sewers. The cables are connected to a distributing board of the original Hibbard type, which is probably the largest construction of the kind in use, being 124 ft. long. At this distributing board the cables are headed up in the usual manner, and from the switchboard side 21-pair switchboard cables are carried up to the three floors occupied by the operating rooms. A feature of the cable heads peculiar to Paris is that each head is fitted with a nozzle by means of which connection may be made with a dry air supply for drying out defective cables, and so restoring their insulation.

The three operating rooms are occupied as follows: The first floor is devoted exclusively to the working of suburban and long-distance trunks, all the lines of this class which enter Paris being worked from the main offices. The operating is done from small switchboards that call for no particular comment.

The second floor contains a multiple switchboard of 6000 lines capacity, and the third another multiple board of 9000 lines ultimate capacity. The first of these boards was ordered in 1891, and is a Western Electric series multiple of 26 subscribers' sections and 10 incoming trunk sections. The second and larger board, ordered in 1895, when the first board had been in use about a year, is a Western Electric bridging board with self-restoring drops of an ultimate capacity of 9300 lines and equipped for 9000 lines. It is the largest board of its kind in use. It contains 30 subscribers' sections of 300 lines each and 15 incoming trunk sections.

These two switchboards practically form two separate exchanges under the same roof, and connections between them are made by means of double-track trunks, as in the case of two ordinary exchanges. This naturally does not work for either rapidity of service or economy of operating, but fortunately for those responsible economy is not necessarily a feature of government systems.

The series board is practically full and the bridging board serves at present something over 6000 subscribers, so that the Paris main exchange serves over 12,000 working lines, making it the largest telephone "central" in the world. There are six other exchanges in Paris situated, roughly speaking, on the periphery of a circle having

the Rue de Gutenberg for a centre. The largest of these is known as Wagram, situated on the avenue of that name, hard by the Arc. This office serves a select residential district and has about 4000 subscribers. The exchange has lately been transferred to a new and handsome stone building erected specially for telephone purposes. Of the other offices three are in special telephone buildings, each serving between 1000 and 2000 subscribers, and two are in leased quarters that will eventually be substituted by telephone buildings.

Schuckert Synchronizer at the Paris Exposition.

A new form of synchronizer is exhibited in the German section of the foreign power house by Schuckert & Co., of Nuremberg, and its action is demonstrated by the aid of an 850-kw three-phase alternator driven by a vertical three-cylinder triple-expansion engine built at Nuremberg by the Augsburg & Nuremberg Consolidated Machine Works. In connection with this alternator, for the purpose of showing the synchronizer in operation, there is provided a small motor-dynamo of 10 horse-power receiving continuous current at 220 volts from the Exposition mains, and delivering three-phase current at 135 volts. A static transformer reduces the alternator e. m. f. from 5000 volts also to 135 volts. The synchronizer is placed in an elevated position, where it may be seen from any part of the engine room. It consists of a ring of incandescent lamps connected between the three branches of each of the two three-phase circuits in such a manner that

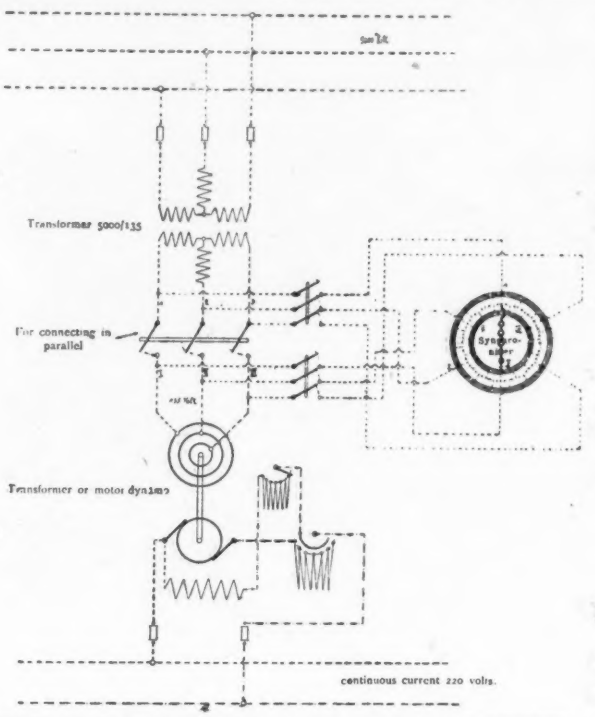


DIAGRAM OF CONNECTIONS OF SCHUCKERT SYNCHRONIZER.

the tendency of rotation due to one circuit is in opposition to that due to the other. When one machine, therefore, is running at a higher speed than the other, the lamps appear in two illuminated segments traveling in one direction or another round the circle. The closer true synchronism is attained—by use of resistance in the armature or field of the small motor—the more steady the illuminated portion becomes. A group of lamps across the centre takes current when the illuminated segments are balanced on either side of the vertical centre line, which indicates the moment when the machines are in synchronism and may be switched in parallel.

PARIS EXPOSITION NOTES.

BIG ATTENDANCE.—Sunday, Oct. 7, has proved to be the banner day for attendance, the visitors numbering over 630,000. Very many people are coming along now, and the Sunday crowds are especially heavy, so that it becomes a difficult matter to force one's way through the dense throng which gazes upon the wonders displayed in Electricity Palace, particularly in the afternoon. A serious endeavor is being made by the administration to increase the number of tickets sold, by providing river carnivals and day and night fêtes in the grounds of the Champ de Mars and Trocadero, and requiring several tickets for each entrance.

EXHIBITORS' DISSATISFACTION.—Much discontent prevails among exhibitors regarding the awards of the juries. It is generally held that the awards are final, and that no changes can be made in them after they are once decided, and it would seem that it would be an unwise proceeding on the part of the authorities to give some ill-used exhibitor justice, because the precedent established would give a right to all exhibitors to have their claims properly passed upon by really disinterested persons able to judge without partiality. Some of the daily papers are taking the matter up, and the *Matin* has published some stinging remarks on the subject which it is to be hoped will produce some good effect. That paper says that never were more errors committed or more unjustified favors bestowed than in the present Exposition, and that it is not merely a few malcontents who call for just treatment, but it is the voice of the whole people raised in protest. The trouble would seem to have originated in the fact that the Minister of Commerce nominated the members of the juries without allowing competent authorities to provide lists of suitable persons properly qualified to act, as was done in the case of the 1889 Exposition with entirely satisfactory results.

Edison Motor Meter.

Mr. T. A. Edison last week had a patent granted to him on a motor type meter. He uses as a device for operating the register train an electric motor connected across the circuit to be metered and to secure constancy of speed of rotation of the motor-armature by the employment of a centrifugal governor possessing great accuracy. The mechanism intermediate the motor and register train, having capacity to convert the constant speed of rotation into a variable speed, may be of any suitable ordinary mechanical construction. A convenient form of variable-speed connection comprises a driving disk with which co-operates a driven roller engaging the working face of the disk and movable diametrically toward and away from the geometrical centre thereof. When the roller occupies a position coincident with the centre, obviously rotation of the disk will not move the roller; but if the roller is moved diametrically toward the periphery of the disk its rate of rotation will be gradually increased. In order that when no current is influencing the meter wear will be prevented between the roller and disk, Mr. Edison provides the latter with a depression coincident with the centre, into which the roller will be normally received. The means employed for changing the condition of the intermediate mechanism comprise an ampere-indicator of great delicacy and accuracy. There is a scale beam mounted on a knife-edge bearing, carrying at one end an armature, core, coil or electromagnet co-operating with a stationary companion element and subjected either directly to the current to be measured or to attraction due to that current, the elements so carried by the scale beam being exactly counterbalanced, whereby the beam will normally occupy a position of equilibrium, and a resisting device being employed to resist the movement of the beam due to the action of the current to be measured and of such a character that the proper proportionality of speed of the register train to the energy consumed will be maintained throughout the necessary limits of registration. The scale beam carries a relatively light coil connected in the main line of the circuit to be metered, whereby the coil will be subjected to the current to be measured. A relatively light counterbalancing weight can thus be employed, thereby reducing the mass of the elements comprising the ampere-indicator. The coil may co-operate with another coil, both being subjected to the current or to a part of the current to be measured; but it preferably co-operates with a stationary armor-clad core of relatively great mass. Mr. Edison uses an ordinary convolute steel spring, connected at one end of the scale beam to oppose the stress due to the current to be measured, as he finds it impossible in this way to secure an ampere-indicator wherein the amplitude of movement of the scale beam is in constant ratio to the energy. Finally, in order that the operation of the ampere-indicator may effect the change in the condition of the intermediate mechanism between the motor and register without excessive friction provision is made wherely at rapidly-recurring intervals the ampere-indicator will be practically disconnected from both the motor and register, whereby during such periods its position may be changed to correspond with any variations in the consumption of the current. This result may be accomplished in a variety of ways—as, for example, by providing the driving disk with a cut-away portion coincident with a section of its area, whereby the driven roller will during a part of each rotation of the disk be maintained out of contact therewith.

The Muskegon, Mich., Independent Telephone Exchange.

FOR six months the Citizens Telephone Company at Muskegon, Mich., has been operating a multiple system. The switchboard was built and installed by the American Electric Telephone Company, of Chicago. The front view of the switchboard is shown by Fig. 1. It has an immediate capacity for 800 lines and an ultimate capacity for 3000 lines. The board is of a metallic circuit magneto call type. The back view is shown by Fig. 2, and the incoming cables are connected to the Burns type of combined sneak current and lightning arrester, as shown by Fig. 3. The toll line work is taken care of by a special equipment, so arranged that the toll lines may be left extended to the main switchboard when there is not enough business to warrant the services of a special operator. The toll line board is built into an equipment together with the chief operator's desk, and is shown by Fig. 4. This equipment is supplied with a very complete supervisory system, and trunk signaling circuits to the main switchboard. The signaling system is so arranged that an incoming call on the main switchboard results in lighting a pilot lamp on both the main and chief operator's switchboards; the lighted lamp indicating the position upon which the incoming call signal is exposed, and where the answering jack may be ready.

The connection between the toll and main boards is made by automatic signals in such a manner as to absolutely prevent the tying-up of the subscriber's connection, and also avoids the usual amount of oral ordering between the operators, which subscribers do not relish, even if no extra charge is made for it. Thus, for example, the main operator upon receiving a request from a local subscriber for toll connection extends this connection through to the toll operator's switchboard by a system of lamp signals.

This signal is operated in the following manner. An operator upon receiving a signal from a local subscriber places an answering plug into the answering jack and learns by inquiry as to the subscriber's needs, and, supposing that it be a request for a toll connection, she would have to select a transfer plug and place it into the multiple jack connecting to the caller's circuit. While this operation is being performed the operator's answering plug still remains in the caller's line jack, and thus keeps the line busy in order that no other operator may cut into the circuit before the toll connection is extended to the toll switchboard. After placing the transfer plug into the answering jack, the local operator withdraws her answering plug and leaves the local subscriber's circuit extended to the toll line switchboard. The moment that the toll operator receives the visual signal thus transmitted, it is responded to immediately; then after the subscriber's request for a given toll connection is received, the toll operator's request for a given toll connection is received, and the toll operator learns by cutting in upon the toll line circuit whether the called-for toll station can be had immediately, or whether the local subscriber must be advised that he will be called when the toll connection can be completed. While the toll operator is thus determining the question of an immediate interconnection, the main operator proceeds with her work of answering and extending local calls. Now, then, if the toll operator desires to release the local subscriber, it is not done by speaking orally to the main operator who has control over the connection at the beginning, but by an auxiliary signaling circuit operated when the toll operator removes her connecting plug from the trunk circuit. This visual signal serves to instruct the main operator to release the toll extension of the local subscriber, which is done by merely removing the trunk plug referred to above. This system is interesting and seems worthy of an investigation by those who are interested in the operation of a toll board separate from the main equipment. This applies not only to the multiple switchboards, but also to all types of divided board equipment.

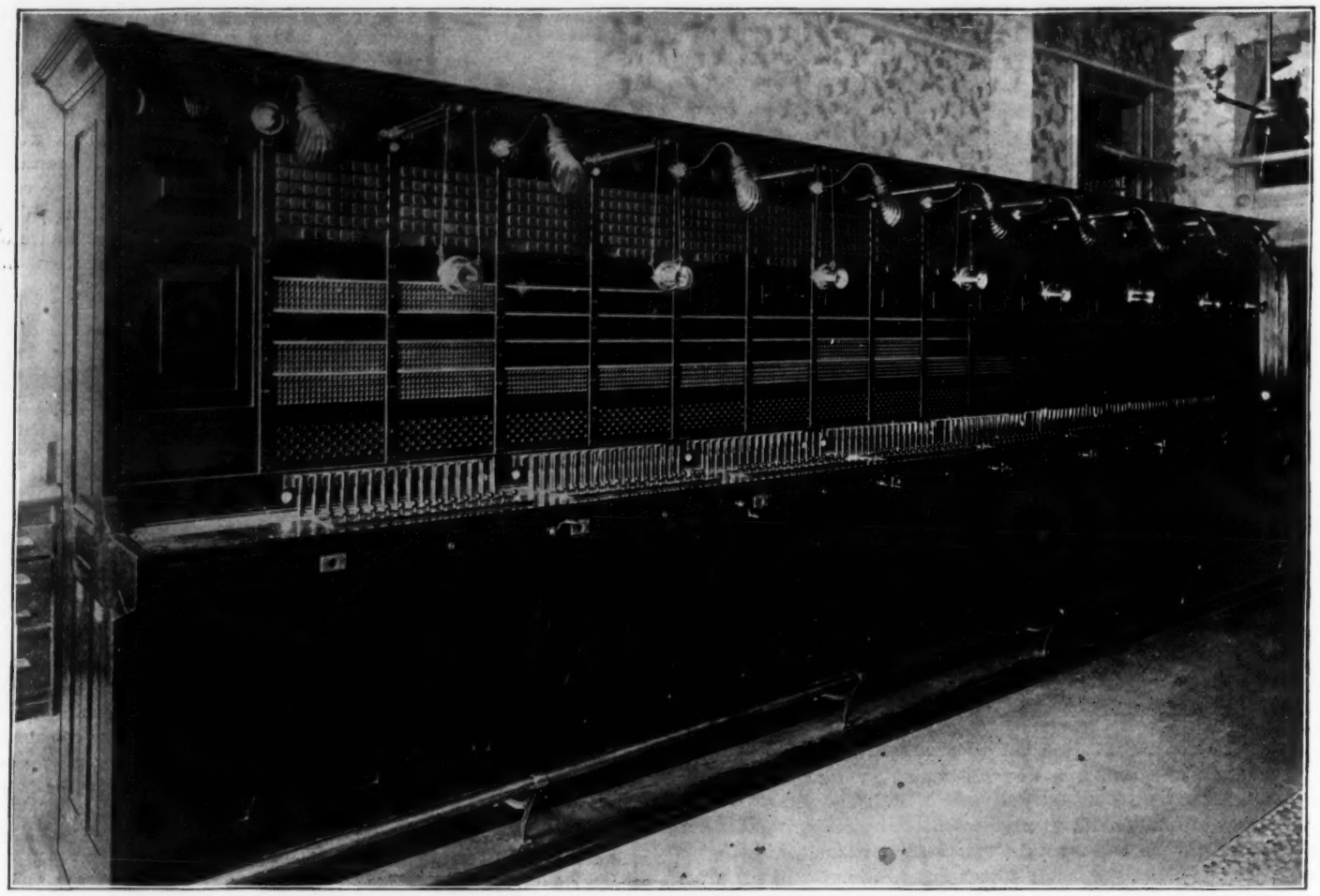


FIG. 1.—VIEW OF THE FRONT OF THE SWITCHBOARD.

The Citizens' Company's exchange is further equipped with a power board and battery charging equipment. The power board has a number of switches and testing instruments required for the various combinations and supervision. The charging machines were made especially to meet the conditions of the Citizens' Company's exchange system, the prime mover consisting of a motor dynamo arranged with primary winding for 500 volts direct current, and the secondary winding for delivering an alternating current at 75 volts suitable for ringing the subscribers' signal bells. This machine is connected by flexible

couplings to a double dynamo, which is wound to deliver two currents, i. e., 12 volts direct current and 6 volts direct current. This equipment is provided with automatic starting switches, which automatically cut off the main current supplied if the 500-volt supply happens to be discontinued, if only for an instant. The 10 and 5-volt circuits are also provided with automatic cut-off switches which serve to cut the batteries free from the charging wires if the driving power should be cut off; this being provided for the purpose of preventing the batteries from driving the dynamos as motors, as would be the case if the driving power should cease.

The system as a whole is operating very successfully, and it would repay any one to visit the exchange. One interesting point in connection with the installation of the plant occurred in the change-over when the old switchboard was cut off and the new switchboard cut in. Prior to the installation of the new switchboard the company was operating an exchange of about 700 drops capacity. These drops were of the series type and wound to a resistance of about 120 ohms.

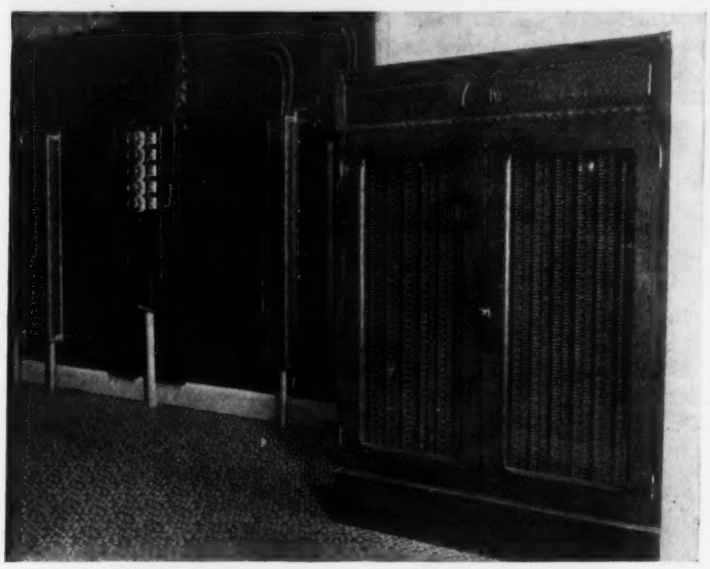


FIG. 3.—TERMINAL HEADS AND CROSS-CONNECTING BOARD.

FIG. 4.—CHIEF OPERATOR'S DESK.

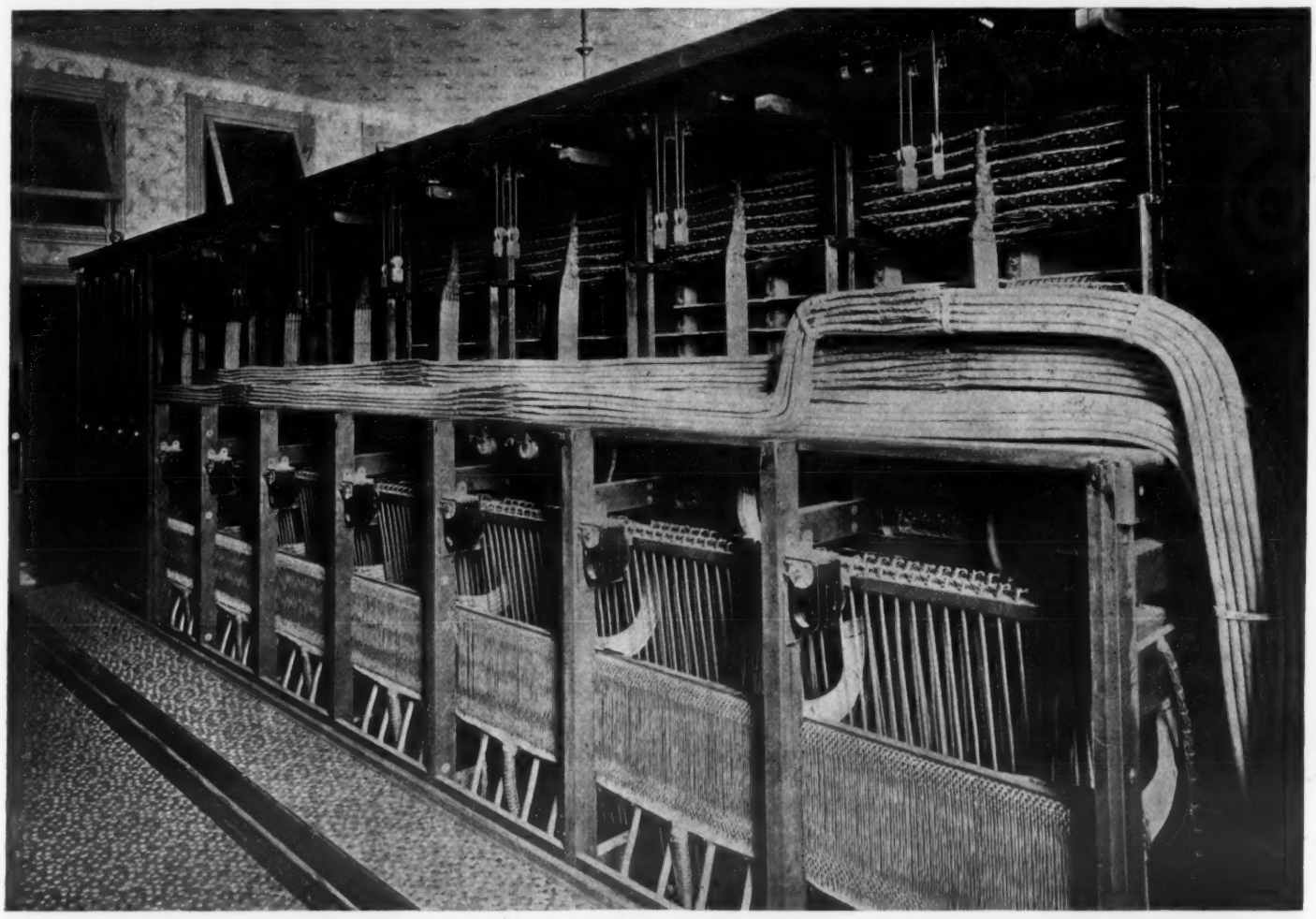


FIG. 2.—REAR VIEW OF SWITCHBOARD.

After examining the general layout of the operating room, the engineer in charge of installing the new board decided to complete its installation from the terminal heads in through the distributing board and to the new board without interrupting the service of the old equipment, and at the same time it was decided to run the outside cables directly into the new terminal heads prior to the change-over. This was done, and the old board was left tapped in onto the outer connectors of the terminal heads, thus leaving the old board in undisturbed operation. The installers then proceeded to connect the

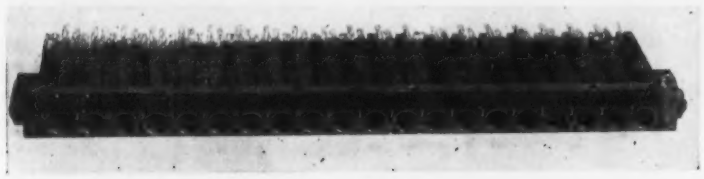


FIG. 5.—STRIP OF MULTIPLE JACKS.

new board completely through the distributing board to the inside connectors of the terminal heads. This would leave but one break between the outside lines and the multiple switchboard circuits, the break being afterwards closed by inserting the sneak current protectors. This work, however, was not done until everything was in readiness for the change-over, prior to which, however, the multiple switchboard was tested and found clear from the terminal heads in. When this work had been done, the operators of the old board were instructed as to the operation of the multiple. As none of them had ever operated a multiple board, this was a very necessary proceeding. The course of instruction was made very thorough, for when an operator was placed at the new board a dozen or so of the sneak current protectors were put into place and the operator instructed in answering calls, these calls coming in on the multiple board as well as the old series equipment.

On April 15 (Sunday) the exchange was ready for changing over, but owing to several causes the time for changing over was postponed until the following morning, and it was accomplished between 8 and 9 o'clock, which, as every telephone manager well knows, is about the busiest time of the week, as every subscriber has his Monday morning telephone calls to be made. The change was made as follows: The operators were left operating the old board, and continued to answer calls until instructed to transfer to the multiple, which order was given after all of the heat coils had been placed in position. All the while that the heat coils were being installed the drops on the multiple board began to fall, together with those on the series board; and the moment that all of the heat coils were found to be in place, the line signals on the multiple board were restored to their normal position. Then the operators at the old switchboard were ordered to change over to the new switchboard, which they did by discarding their head telephones and passing across the room to the new switchboard, adjusting the new head telephones in place and proceeding with the operation of the new board. At the same time, the old distributing board fuse circuits were opened, which cut off the old switchboard altogether, and before noon the entire old equipment had been torn out of the office, and the operation of the new equipment had begun and continued without interrupting the service of a single calling subscriber.

Fig. 5 shows a strip of multiple jacks. These jacks are mounted up as shown, with 20 sets of jack springs and openings. The body of the jack is cut from a solid block of hard rubber; all parts are mounted in a substantial manner. The springs are of the best grade of German silver, and all parts of the jack are finely finished.

Experimenta Conduit Line of the London County Council.

In the tramyard of the London County Council at Camberwell is installed an experimental length of an electric tramway track. The line has been erected so as to be tried under actual working conditions; it is in the open air, has a curve of 90 ft. radius and a gradient of 1 in 40. The total length of the line is 256 ft. This, the first portion of the electric tramway work of the London County Council, is now in running order, and surrounded as it is by the numerous stables, sheds and buildings containing all the paraphernalia of an extensive system of horse tramways, appeals in a peculiar manner to the onlooker. In the centre of a vast home of the oldest of tramway fashions has sprung up a small, one might almost say, a toy, length of the newest tramway practice. The entire plant formed part of the exhibit of the British Westinghouse Company at the International Tramways and Light Railways Exhibition held in London last June. This operating tramway was the most striking of all the exhibits, and was described and commented upon in practically all the technical journals and newspapers at that time. It may, however, be as well to glance over the main points of this tramway system, now that it is likely to be a centre of interest both to the rate-payers of London and the authorities of other cities who are waiting for London's example before deciding upon electric tramway schemes themselves.

TRIAL CONDUIT ROAD OF THE LONDON COUNTY COUNCIL.

The tramway was purchased by the London County Council for the purpose of training motormen to drive electric cars and to enable their engineers to carry out certain experiments, while at the same time they will see for themselves the appearance and behavior of the conduit system under actual working conditions. The generating plant, consisting of gas engine and dynamo, has been hired by the council until its own station shall be available. The line is built on a series of cast-iron yokes, placed 5ft. apart, centre to centre, and each set on a bed of concrete 4 ins. thick. This thickness is sufficient for the heaviest traffic on the street. The yokes bear the tram rails at their extremities and the conduit section and channel rails in the centre. The conduit between the yokes is of concrete about 4 ins. wall. The lead and return conductors are run side by side in the conduit. Both are insulated at their supports by stoneware insulators. The conductors are split up into sections, each section being coupled by a branch main to a continuously insulated main running the full length of the track. An automatic switch is placed in each of the branch mains, and is so arranged that its corresponding conduit conductor section is only coupled to the main when a car is actually over it. The car is equipped with two Westinghouse No. 49 motors, each 35 horse-power, and coupled to the car axles through a single reduction gear. Current is collected from the conduit conductors by means of a contact plough fixed beneath the car, and passing through the narrow surface slot, three-quarters of an inch wide, of the conduit.

The contact plough is suspended by a hings from a small carriage beneath the car. The hinge is for the purpose of allowing the plough to accommodate itself to curves in the track. In addition, the carriage allows a lateral motion almost equal to the full width of the car, so that a considerable eccentricity of the conduit channel between the track rails can be allowed. The advantage of this will be seen in certain parts of the track construction, such as turn-outs, etc., and, in addition, it will, of course, be useful in avoiding obstacles in the roadway. The car is equipped with a Westinghouse magnetic blow-out type controller at each end for facilitating running in either direction, and with an electrical brake in addition to the ordinary hand brake.

The power for operating the line is yielded by a 75-kw, 500-volt generator direct coupled to a 125-hp Westinghouse three-cylinder gas engine. The engine is of the type which has attracted so much attention and become so popular during the last two years or so, due to its economical working and sensitive governing.

The Barmen-Elberfeld Suspended Electric Railway.

A special cable despatch from Berlin of Oct. 24 says: "Emperor William and Empress Augusta Victoria to-day dedicated with elab

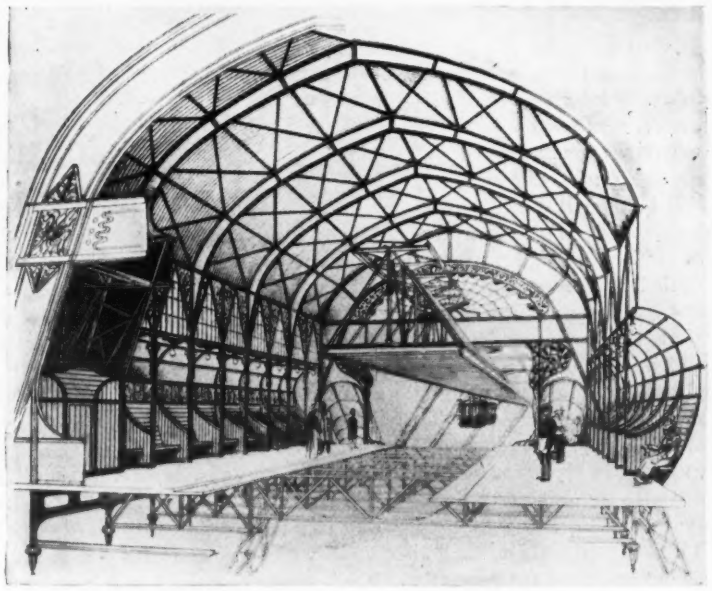


FIG. 1.—INTERIOR VIEW OF STATION.

orate ceremony the suspension railway which runs along the River Wupper and connects Elberfeld and Barmen, a high, ingenious structure. The Kaiser made the initial ride over the line. Subsequently his Majesty attended the dedication of the Hall of Fame in Barmen. Replying to an address by the Burgomaster, the Emperor warmly acknowledged, on behalf of the Empress and himself, the cordial reception tendered him by the people of the town." With regard to the ingenious line thus opened with so much eclat, we are able to give some views and details herewith. The line has been under construction for some time, and the benefits of such form of structure remain to be proved. It would seem at first blush that for freight a modern telpherage system would be preferable, and that for passengers cars

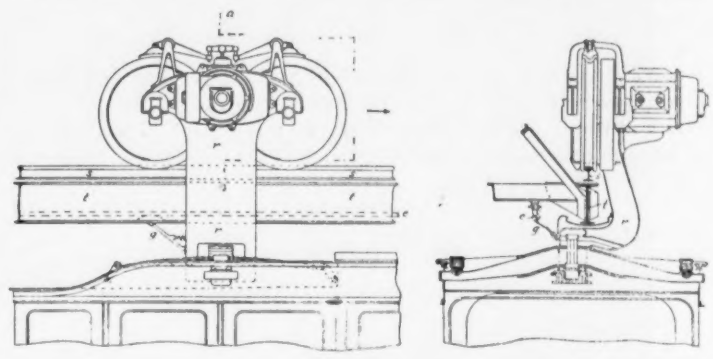


FIG. 2.—DETAILS OF SUSPENSION TRUCK.

running on ordinary tracks would be just as desirable. Time will prove. A system of this kind with suspended cars was worked out by Capt. Lina Beecher in company with Messrs. Clarence E. Stump and T. C. Martin, seventeen years ago, and steps were taken by them to put up a line at the Philadelphia Electrical Exhibition of 1884. Capital was, however, slightly too sceptical, and none of the three collaborators were millionaires in their own right, so the scheme was not developed.

The line runs from Barmen through Elberfeld to Vohwinkel, a distance of about eight miles. The system consists essentially in the employment of a single rail fixed to the under surface of a viaduct, which latter is supported by a light lattice-work construction. No less than six miles of the line is supported over the Wupper River, the construction here used being shown in Figs. 2 and 3. Over other portions of the route an arched support is employed, as shown. The minimum radius of curves is 300 ft. and the steepest grade is 4.5 per cent.

The cars are suspended flexibly to permit of going around abrupt curves. At a speed of 15 miles per hour the car body is inclined at

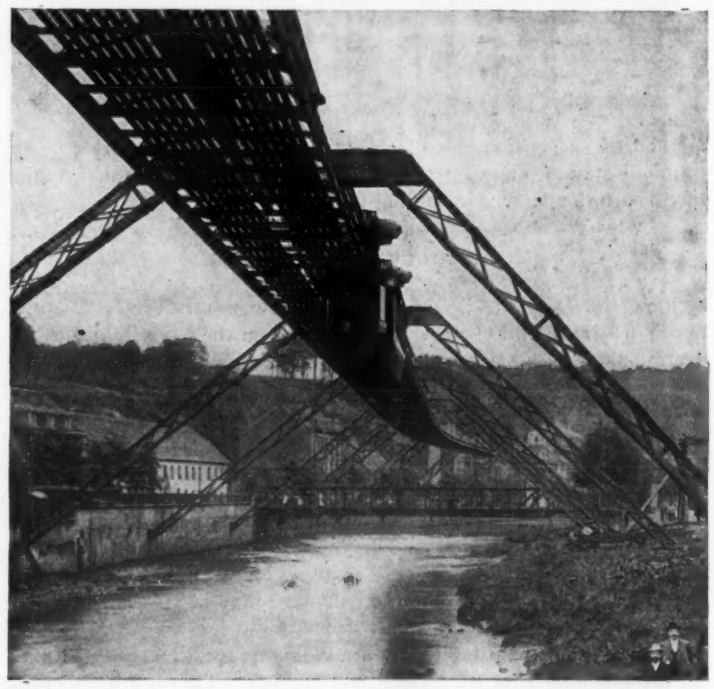


FIG. 3.—SUSPENDED RAILWAY STRUCTURE OVER THE WUPPER RIVER.

an angle of 25 degs. when passing around curves, without, however, any inconvenience to passengers, it is stated. Each suspension truck is supported by two driving wheels, which receive power from an electric motor through gearing by means of an intermediate pinion mesh-

ing with a pinion mounted on the axis of the motor, and with a spur gear on the wheel.

The motors are rated at 36 horse-power at 500 volts, and are controlled on the usual parallel series system from the front platform of the first carriage of a train. The current is taken from a light rail by means of a sliding shoe held in contact by a spring. In the case of a train of two or more cars, the first car alone is fed directly by the current, a flexible cable of several wires supplying the necessary current to the other cars for motors, incandescent lamps or bells. Every car will have a motor equipment. Westinghouse air brakes are used, the reservoirs being refilled at the terminal points of the line. The intention is to run the cars at a speed of 30 miles per hour, which will give an average speed of from 18 to 21 miles an hour. Trains of two cars will run under a headway of two minutes, and will be controlled by an automatic block signal system.

The cost of the line proper will not, it is stated, exceed $200,000 per mile. The cost of the equipment of the system will be $540,000, on the basis of a train every three minutes, carrying 100 persons at a speed of from 24 to 30 miles an hour. In addition to the line and the method of suspension, we illustrate the exterior and interior of the terminal station, showing the structure and the method of bringing the cars to the passenger landing platform.

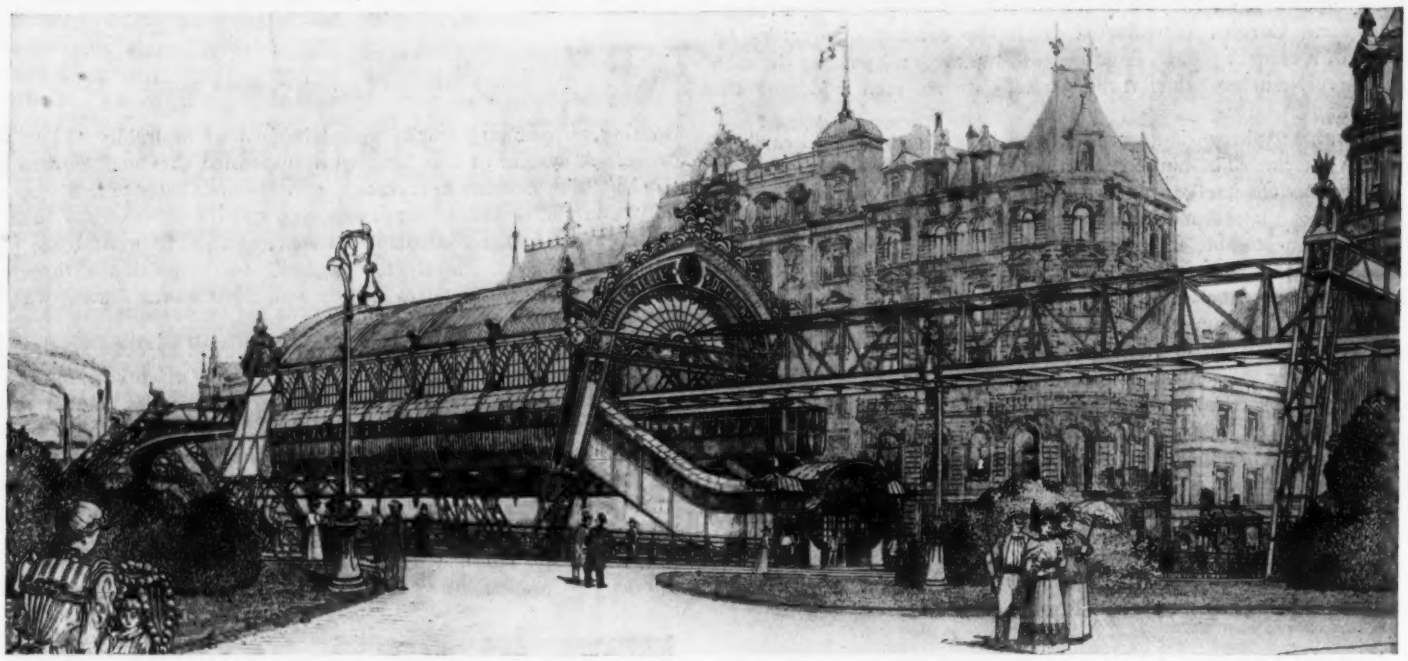


FIG. 4.—EXTERIOR VIEW OF STATION, BARMEN-ELBERFELD RAILWAY.

Telephony in Australia.

Some time ago the Governments of New South Wales, Victoria, South Australia and Queensland conferred on the advisability of connecting their respective capitals. The advisability was conceded, but the cost was declared to be prohibitive. It was finally agreed that wires should be laid only between Brisbane, Sydney and Melbourne, and the requisite outlay was put at $200,000. The Postmaster General of Victoria is now calling for estimates for the construction of the line between Melbourne and Sydney, the original expense of which was computed at $120,000, of which $40,000 was to be borne by Victoria and the rest by New South Wales. The suggested charge for using the wire the whole distance is $1.25 for five minutes. The reason why the more extensive intercolonial proposal was deferred was the slight possibility of earning a reproductive revenue, but experience shows that if through rates are moderate local income will make up for any deficiency of income at terminals. This argument, however, is most effective when applied to a fairly densely populated country, which Australia is not. This is a defect time is fast remedying, and no doubt the principal reason for continuing the Melbourne-Brisbane line to Adelaide, and even to Perth, when the first section is laid will be the very existence of that section.

The New Storage Battery of the Kansas City Electric Light Company.

For several years following the panic of 1893 business was almost at a standstill in Kansas City owing to the unnatural boom conditions that existed for several years previous to that time. Electric lighting interests suffered with everything else. The prosperous times of the past few years have been felt the more decidedly in Kansas City, however, because of the former loss of confidence, and the increase in electric lighting has been on a par with the increase in other lines. Early this year parties interested in the Metropolitan Street Railway acquired control of central station electric lighting in the city, and a more aggressive policy than prevailed before was adopted. Solicitors were put out and an effort was made to get new business, with results that were almost startling so rapid was the increase in demand. Ever since the inauguration of the new management and policy, the engineering department has been kept busy with plans to take care of the immediate increase and give good service, and almost all its efforts have necessarily been concentrated in that direction, though all plans have been made with a view to a multiphase distribution ultimately. C. F. Holmes is president of the company, and Peirce, Richardson & Neiler are consulting engineers, Mr. Richardson now spending most of his time in Kansas City and taking the management of the company.

It became absolutely necessary to do something to take care of the heavy load on the central down-town station of the company near Seventh and Wall Streets the coming winter, and the quickest installed and most suitable piece of apparatus was decided to be a storage battery, especially as the storage battery would be useful after the company has built its new multiphase generating plant which it will probably put up in the outskirts of the city, and a steam plant would not. Accordingly a battery was contracted for with the Helios-Upton Company. This is the first large central station battery and switchboard ever turned out by this company, and has a number of novel features of interest. The battery consists of two sets of 800 amp.-hour battery, one for each side of the 110-volt three-wire system. This 800 amp.-hour rating is for a one-hour discharge rate. There are 70 cells on each side, 20 of which are end cells which may be cut in or out for regulation. Each cell is contained in a lead-lined wood tank 44 ins. long, 18½ ins. wide and 19 ins. high. There are 20 positive and 21 negative plates in each cell, with dimensions 9 ins. by 14½ ins. Three glass rods between each pair of plates serve as separators. The cells are insulated from the floor by porcelain knobs which in turn rest on two layers of vitrified brick. The battery room

is shown in Fig. 1. It is adjoining the dynamo room, and may be double-decked later on if the battery is to be enlarged. Being over the boilers, it became highly important that no spilled or leaking electrolyte finds its way through the floor. Accordingly the floor has been covered with three-sixteenth-inch sheet lead burned together at joints, making an excellent acid-tight floor. The plates used in this battery are the regular Helios-Upton type, which is a simple grooved plate with chemically-formed active material filling the grooves. The specific gravity of the sulphuric acid electrolyte is maintained at 1150 degs. at full charge, the electrolyte when made up being slightly below that. The voltage of the battery when "floating" across the lighting mains is 2.5 volts per cell, and when discharging from 2 to 1.8 volts per cell, according to the amount of discharge. The open circuit voltage of the cells is from 2 to 2.2 per cell. In setting up the cells, it takes from 25 to 30 hours charging and discharging to bring the cells up to standard. The lugs of the plates are made by slitting off a piece from the top of each plate, and bending it back. The bus-bars for each cell are soldered to these terminal

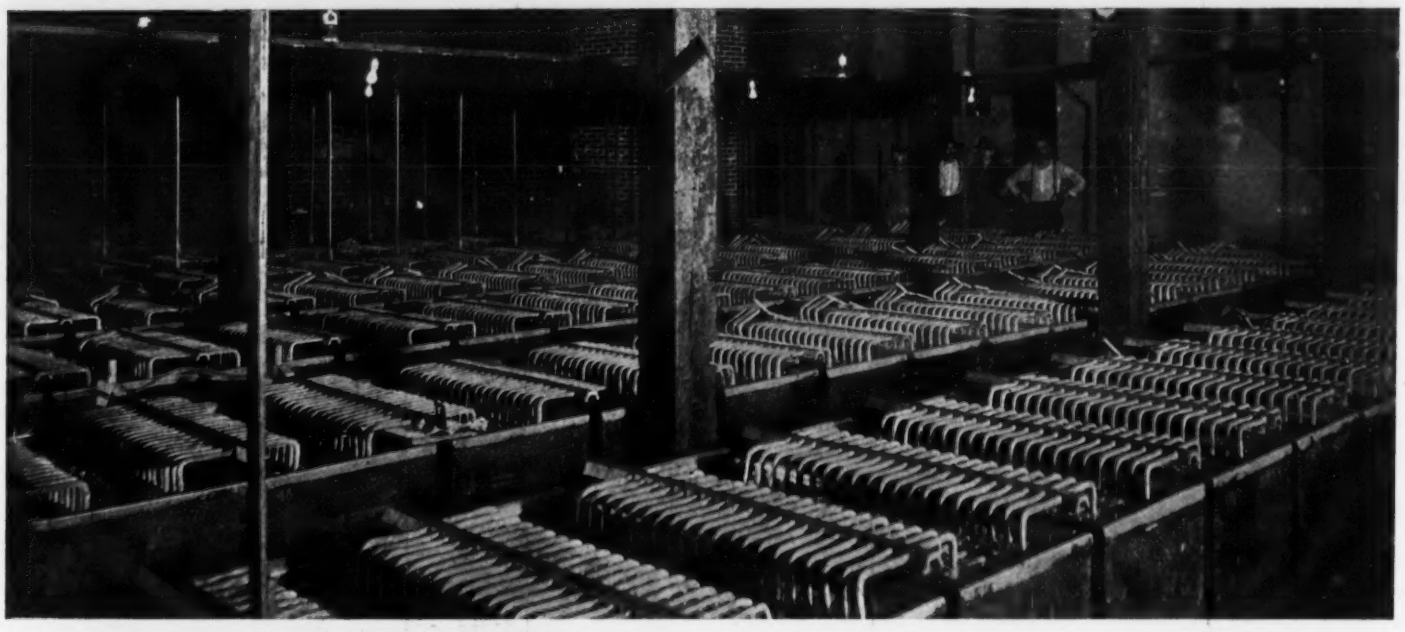


FIG. 1.—BATTERY ROOM, KANSAS CITY ELECTRIC LIGHT COMPANY.

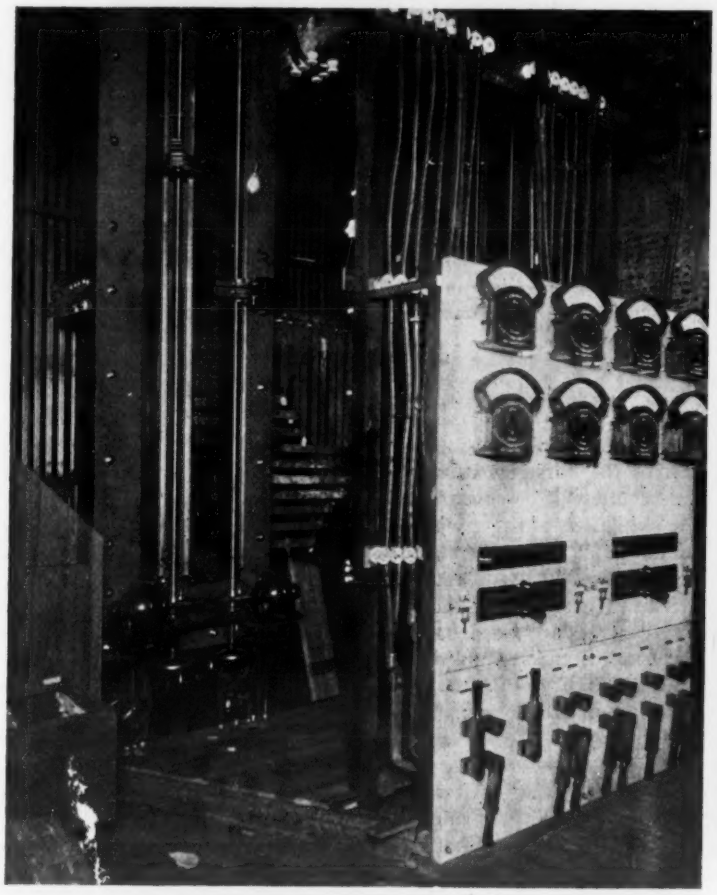


FIG. 2.—END-CELL SWITCH AND SWITCHBOARD.

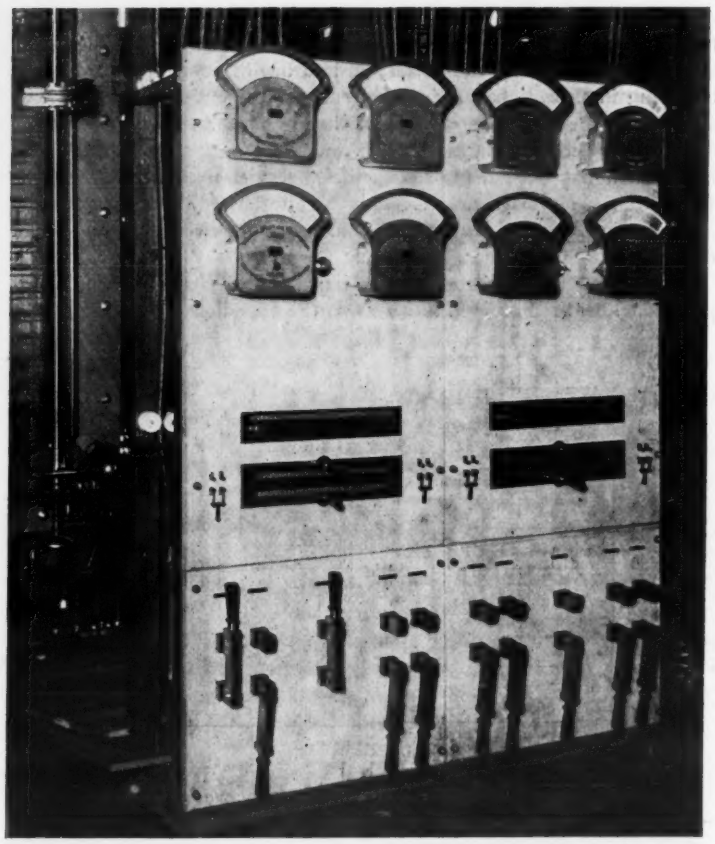


FIG. 3.—SWITCHBOARD.

lugs with lead-bismuth solder. The arrangement of bus-bars can be seen in Fig. 1. A clear space of 2 ins. is allowed between the plates and the tank lining on all the cells. The end cells are all connected to the end-cell switch in an adjacent room by copper bars, ⅜ ins. by 2 ins., lead coated.

The end-cell switches were designed by Mr. Thomas Spencer, general superintendent of the Helios-Upton Company. There is, of course, one complete end-cell switch for each side of the three-wire system. There is also a duplicate arrangement on each end-cell switch for allowing some of the end cells to be charged while the battery is in service. The method of doing this is made plain by the diagram, Fig. 4. A separate pair of generators is run whenever it is necessary to charge the end cells. An ammeter and voltmeter are provided on the switchboard for the charging circuit, as well as the discharging circuit, hence the arrangement of instruments shown in Fig. 3, which illustrates the storage battery switchboard. On each side of this board there is one differential ammeter for use in the main circuit, and one voltmeter; also an ammeter for use when the end cells are being charged, and a low-reading voltmeter, with which the voltage of any cell in the set of end cells can be read. It is, of course, necessary with the arrangement mentioned to have two contacts on each end cell switch. The end cell switches are operated by small Lundell motors, as shown in Fig. 2, which illustrates one of the end cell switches. The position of the end cell switch contact is indicated by a pointer on the switchboard, as seen in Fig. 3. To operate a motor which moves an end cell switch contact, it is only necessary to throw the handle on the indicator, as seen on the switchboard, in the direction in which it is desired to run the contact, and hold the handle in that direction until the contact has reached the desired cell. The end cell switch contact avoids short-circuiting between cells by being divided into two parts, as seen, and having the two parts connected by a German silver shunt. The space between the commutator bars of the end cell switches is filled with hard rubber insulation, but has two copper ribs embedded in the insulation to give the hard rubber mechanical strength and avoid trouble, should the rubber become pitted by arcing. The end cell switches have an ultimate capacity of 30 end cells, although only 20 are now so connected. At the bottom of the switchboard, Fig. 3, are the main switches for throwing the battery in and out of service, and also for throwing in the special charging circuit for the end cell switches. In addition to the operation of the switches by motors, they may also be operated by the hand-wheel, shown under the motors in Fig. 2. The installation has been made under the supervision of Mr. George E. Brett, of the Helios-Upton Company. The battery will probably be called on to carry the peak of the load for about two hours on winter evenings.

In addition to this battery the Kansas City Electric Light Company has also been obliged to resort to the expedient of buying power

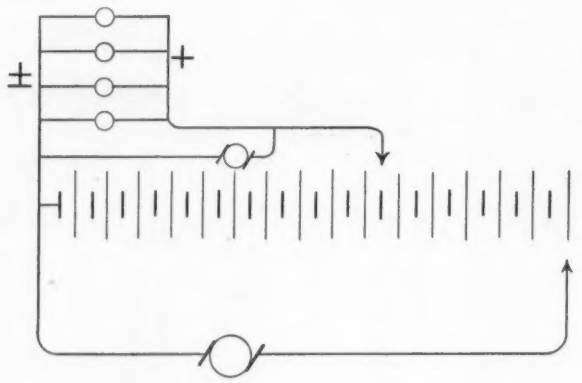


FIG. 4.—DIAGRAM SHOWING METHOD OF CHARGING END CELLS.

from the Metropolitan Street Railway. A 600-kw rotary converter, exhibited by the General Electric Company at the Street Railway Convention, will be put in the Central Avenue power house, and will convert the 500-volt current generated by that station into a three-phase alternating current, which will be stepped up to 6000 volts for transmission to a sub-station of the electric light company near Twelfth Street and Grand Avenue.

Preparations for the Automobile Club Show.

During the present week work has gone on actively for the show of the Automobile Club of America at Madison Square Garden. The show opens on Saturday night. A striking poster has been put up all over New York, and Mr. A. R. Shattuck, who has just been elected president of the club, has been doing excellent work in organizing

(Flashlight photograph.)

PRESIDENT SHATTUCK AT THE AUTOMOBILE CLUB.

the forces of the club. It is hoped that enough may be realized for the affair to enable the club to carry out certain plans that it has in mind for the promotion of automobilism.

On the track at the Garden, one-sixth of a mile in circumference, vehicles will be in motion all the time. One of the features of the show will be an exhibition of hill-climbing. Up on the roof of the Garden has been constructed a runway of solid timbering, beginning at the centre of the roof garden, running along the Madison Avenue side, turning at the Madison Avenue corner, and continuing up into the second story of the tower. The grade is steeper than any which is likely to be met on the ordinary road in this part of the country, and is only found in the mountainous districts of the West, where the test of the horseless carriage is greatest. On the artificial hill the locomobile will be run to show that no grade is impossible to it, and the exhibition of the machine under these conditions is sure to be one of the most interesting features of the show, as, in addition to the steepness of the grade, there is a sharp turn midway up the incline.

The programme for the competitions at the Automobile Show, at Madison Square Garden, Nov. 3 to 10, under the directions of the technical committee and the contests and exhibition committee of the Automobile Club of America, C. J. Field, chairman, is as follows, with some possible changes:

Saturday, Nov. 3—Evening, 45 minutes, obstacle contest for steam vehicles.

Monday, Nov. 5—Afternoon, 45 minutes, brake contest for electric vehicles. Evening, 45 minutes, obstacle contest for electric vehicles.

Tuesday, Nov. 6—Afternoon, 45 minutes, brake contest for gasoline vehicles. Evening, 45 minutes, obstacle contest for gasoline vehicles.

Wednesday, Nov. 7—Afternoon, 45 minutes, brake contest for steam vehicles. Evening, 45 minutes, obstacle contest for steam vehicles.

Thursday, Nov. 8—Afternoon, 45 minutes, brake contest for electric vehicles. Evening, 45 minutes, obstacle contest for electric vehicles.

Friday, Nov. 9—Afternoon, 45 minutes, obstacle contest between operators of electric cabs for hire, also stopping contest. Evening,

45 minutes, competition of electric delivery wagons, obstacle contest and stopping competition.

Saturday, Nov. 10—Afternoon, 45 minutes, championship competition and obstacle contest between winners in steam, electric and gasoline vehicles. Evening, 45 minutes, championship between winners of stopping competition in steam, electric and gasoline vehicles.

The afternoon contests will begin at 4 o'clock and the evening contests at 9 o'clock.

In the obstacle race, posts, barrels and other obstacles will be placed at intervals along the track in the Garden, and the chauffeur will be required to ride around the track at a good rate of speed, dodge around the obstructions, and, in fact, come in contact with the many things which may occur on a road to upset the even tenor of his way. The driver who makes the best record will receive the prize. The braking competition is really a test of brakes, as the contestant after getting his machine going at the prescribed rate of speed will be called upon to stop, and the one sliding the least distance after the brakes are applied will be the winner. For gasoline vehicles the machines must have all the parts so cold that the judges may place their hands upon them. Competitors must stand a few feet away from their machines, run up to them on the word, mount, start their automobiles, and run them the straight side of the Garden to a mark, and the winner will be the one who does the feat in the shortest time. Gymkana sports will also be carried on of an amusing character. Well known automobilists will act as judges in the different events.

Manufactured Exportations from the United States.

The manufacturers of the United States are rapidly increasing their share in the foreign commerce of the country. Nearly one-half of the importations are now for their use and more than one-third of the exportations are their products. Their importations during the nine months ending with September, 1900, amounted to $281,000,000, a daily average of over a million dollars, while their exports of finished goods in the same time amounted to $338,000,000, a daily average of more than a million and a quarter dollars. Never before in the history of the country have the manufacturers figured so well in both directions. In the corresponding nine months of last year the importations of manufacturers' materials amounted to $242,000,000, or $40,000,000 less than in the nine months just ended, and the exports of manufactures amounted to $277,000,000, or $60,000,000 less than in the corresponding months of this year. In the nine months of 1896, ending with September, the importations of manufacturers' materials amounted to $183,000,000, as against $281,000,000 in the corresponding months of 1900, and the exports of manufactures amounted to $184,000,000, as against $338,000,000 in the corresponding months of 1900. Thus the manufacturers during the four years have increased their importation of materials for use in manufacturing more than 50 per cent, and increased their exportation of finished manufactures more than 80 per cent. Manufacturers' materials a decade ago formed but 33 per cent of the total importations; now they form over 45 per cent of the total imports; while finished manufactures, which a decade ago formed but 18 per cent of the exports, now form over 33 per cent of the exports.

The following table shows the importations of manufacturers' materials and the exportations of manufactured goods in nine months ending with September in each year from 1886 to 1900:

Nine months ending Sept. 30—	Manufacturers' materials imported.	Manufactured goods exported.
1886	$175,889,544	$101,625,414
1887	190,834,580	98,101,603
1888	175,784,865	99,842,972
1889	198,221,116	111,115,263
1890	208,853,767	113,899,554
1891	225,807,206	126,911,057
1892	219,091,192	111,290,024
1893	224,491,726	129,998,845
1894	169,201,132	133,378,609
1895	238,402,550	145,793,834
1896	183,752,693	184,807,004
1897	200,510,839	212,478,810
1898	193,482,109	227,822,045
1899	242,178,074	277,502,649
1900	281,675,019	338,678,243

Mr. Glidden on the Telephone Outlook.

Mr. C. J. Glidden, president of the Erie Telephone & Telegraph Company, was in New York last week, taking an active interest in the annual election and meeting of the Automobile Club of America. He is himself an enthusiastic "mobler," and handles skilfully three different types of Columbias which he has bought for family and personal use at Lowell. While he believes strongly in the future of the electric automobile, he is necessarily concentrating his attention on the telephone field, in which he has been conspicuous so long. Speaking of this line of work at the Automobile Club, he said: "The year 1900 will show the largest development in the telephone field since the invention of the telephone, and the year 1901 will witness some remarkable combinations of electrical properties in various sections of the United States."

"To be definite, Mr. Glidden, what do you give as your careful estimate of the development?"

"The growth in the United States will not be far from 240,000 subscribers. The investment during the year in all properties will be in the neighborhood of fifty millions of dollars, divided as follows:

Real estate	$2,000,000
Long-distance lines	10,000,000
Exchange and new switchboards	38,000,000
Total	$50,000,000

"The total investment in telephone properties in the United States will not be far from $200,000,000."

"How about the telephone properties to which you give personal direction?"

"The Erie system now operates 136,000 subscribers in eight States, and will close the year with a list connected and waiting connection of 150,000, or a gain during the year of about 37,000. The work done throughout the territory is of a most substantial character. The new relay switching apparatus is being installed at all points in the company's fireproof buildings on land owned by the company. At present, we have 66 buildings valued at about $2,000,000, located in cities where the underground system has been established. Our development this year will cost at least $7,000,000, $2,000,000 of which goes into the long-distance lines; the total number of miles in operation will not be far from 250,000. The telephone business of the United States has only reached a 25 per cent development, considering that San Francisco and Los Angeles have reached possibly 75 per cent development; San Francisco has 20,600 subscribers, population 342,000; Los Angeles 7800 subscribers, population 102,000."

"Do Eastern cities compare with those of the Pacific Slope in this rapid growth?"

"Well, I hope soon to be able to say so. In the Erie system, Cleveland, Ohio, has attained a development of 15,000, population about 400,000. The number of telephones in the United States should be to-day, based on the development of exchanges equal to that of San Francisco, at least 2,500,000, as against, say, 800,000 at present."

CURRENT NEWS AND NOTES.

ALUMINUM CABLES.—The Niagara Falls Power Company is stringing aluminum cables on the new power transmission line now being built between Niagara Falls and the Tonawandas.

PHILIPPINES CABLES.—Gen. Greely has received a report from Manila saying that sixty miles of cable for use in the Philippines has arrived, and will enable the Signal Corps to complete a number of telegraph lines on the islands.

THE NATIONAL ELECTRIC LIGHT ASSOCIATION having many inquiries for such data, is sending out to its members copies of Francisco's "Municipalities vs. Private Corporations" as an antidote to municipal ownership arguments and agitations.

PARIS-BERLIN TELEPHONY.—Nine girls have been specially engaged to take charge in the Berlin central telephone office of the service with Paris. By agreement French has been adopted as the official language, as many Germans know French, but few French know German.

LONG AUTOMOBILE RIDE.—Mr. John L. French, of St. Louis, Mo., recently made the trip from St. Louis to Chicago in an automobile, a distance of 450 miles. The run was accomplished in 36 hours. The automobile was of the gasoline type, and consumed 18 gallons of gasoline in making the trip.

MUNICIPAL OWNERSHIP.—The City Council of Chicago went on record lately for municipal ownership of all gas and electric light plants. A commission will be appointed by Mayor Harrison to draft a law for submission to the next General Assembly. The Council adopted also a resolution fixing the maximum price of gas after the first of next January at 75 cents per 1000 ft.

THE CHICAGO STOCK QUOTATIONS.—The Western Union and Postal Telegraph Companies have made an offer to the Chicago Board of Trade of $24,000 a year for its market quotations. The Board made a counter proposition asking $52,000 and prohibiting the Western Union from distributing the quotations on the local tickers. The prospects for a settlement of the differences are now regarded as very remote.

LONDON-BRUSSELS TELEPHONE LINE.—Consul Roosevelt sends the following from Brussels, Sept. 25, 1900: "After months of experiment, it has been decided to establish telephonic communication between England and Belgium, to be opened to the public about Feb. 1, 1901. The Belgian line will start from La Panne, near the French frontier, and will be about 74 km (45 miles) long. The tariff is fixed at 10 francs ($1.93) per three minutes.

A SEARCHLIGHT BATON.—The present national election has yielded telephonic speeches and automobile campaigns, to which must now be added searchlight batons. At Madison Square Garden, New York, on Oct. 26, the singing by 40,000 persons at the reception to Governor Roosevelt was led by a conductor up on the tower, who waved his beam of light to and fro. The crowd on the streets below thus sang "America" with ease and magnificent effect.

MUNICIPAL OWNERSHIP OF LIGHTING PLANTS.—During the recent annual meeting of the Indiana Municipal League in Richmond, strong grounds were taken in favor of municipal ownership of electric light and water plants. Attorney Haywood, of Lafayette, made a vigorous speech in opposition to municipal ownership as a general thing. He thought that municipal ownership of water works was more to be desired than of lighting plants, his reasons being that water is nature's supply while light is a manufactured product and therefore a much more difficult problem to deal with.

PANEL BOARD AND FUSE HOLDER.—Invention aimed at the compactness and simplification of switchboards and panel boards goes steadily on. Mr. C. J. Klein, well-known in New York electrical manufacturing circles, has just taken out a patent on work in this line. The chief objects of his invention are to decrease the width or size of the panel board and at the same time separate the opposite terminals of the branch circuits as far as possible. This he does by mounting the bus-bars edgewise and in two-wire systems mounting the like terminals of the branch circuits upon the same side of the bus-bars. Second, to improve the construction of the removable fuse holders and to bridge all the bus-bars and effect direct connections from the working bus-bars to the branch circuit terminals.

HYDRO-ELECTRIC POWER IN ITALY.—It is said that Italy is gradually making herself independent of foreign coal, by substituting electrical for steam power. Prof. Colombo has reckoned that up to April 30 last 600,000 horse-power had been already created with hydro-electric plants, of which, however, only 300,000 horse-power had been utilized for industrial purposes. This, however, is only a small portion of the power which a proper exploitation of the numerous water courses of the country could yield, the total being reckoned at 3,000,000 horse-power. The progress of electro-technics and other factors make the production of electric power in Italy considerably cheaper than the production of a corresponding quantity of steam power. The 300,000 horse-power at present utilized represents a saving in coal of 80,000,000 lire yearly. Prof. Colombo calculates that if all power were produced by electricity instead of steam, Italy would save millions of dollars in coal, and still possess an immense reserve of motive power.

OPERATING DISTANT TORPEDO BOATS.—Lieut. B. A. Fiske, U. S. A., who took an active part in the battle of Manila and is well known for his range-finder and other electrical inventions, has received two broad United States patents on apparatus for controlling distant moving vessels or vehicles by etheric waves, Hertzian radiations, etc., combined with coherers and kindred devices. The applications were filed as far back as September, 1898. The specifications of the invention are very interesting, although the gallant officer disclaims any wish "to enter into vague and imaginative speculations as to the extent of its application or its possible value to mankind." The unusual breadth of the claims may be inferred from the following: "The combination with a source of electrical waves or disturbances of a moving vessel or vehicle and mechanism thereon for steering or operating the same, and controlling apparatus adapted to be actuated by the influence of the said waves or disturbances at a distance from the source, as set forth."

A BULBOUS ARC LAMP.—A patent in this country has been issued to J. J. Rathbone, of London, England, on a "bottle" enclosed arc lamp. He prepares a glass or bottle-like globe or chimney, in the upper part of which he places the upper carbon pencil. The neck of this bottle, globe or chimney carries, say, a metallic tube insulated or not, as desired, from the lower carbon pencil, which is within and is guided by an inner tube or carbon holder acting as a central core of a solenoid which is surrounded by a magnet or shunt coil, single or double, as desired. The lower end of this core is by a light flexible chain or wire connected to the bottom plate of the lamp, which for the purpose may serve as one of the pole plates, the socket of the upper carbon capping or clip being the other pole. The light flexible chain or wire connection is of importance in this invention, because its flexibility permits of the lower carbon rising proportionately to the consumption without breaking the current, and the solenoid preserves the regularity of the arc distance of the carbon points. The light flexible chain or its equivalent may be used in conjunction with mercury in the base of the lamp or alone, as found necessary.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY.—The formal inauguration of Dr. Henry S. Pritchett, former Chief of the United States Coast and Geodetic Survey, as President of the Massachusetts Institute of Technology, took place on Oct. 24 in the new Symphony Hall in Boston. A distinguished company was present, consisting of representatives of colleges and universities from all parts of the country and of the alumni, the entire main body of the hall being filled by the students, 1250 or more in number. Brief addresses were made by Senator Henry Cabot Lodge, by Col. Thomas L. Livermore on behalf of the corporation, and by former President Crafts. The principal feature, however, was, of course, the inaugural address of the incoming president upon "The Relation of Educated Men to the State." It was peculiarly suggestive. His insistence upon the obligations of the institutions of higher learning to maintain about themselves an atmosphere favorable to the growth of a wholesome type of civic virtue is especially appropriate and inspiring, coming, as it happens, upon the eve of a national election.

CHURCH AGAINST TELEPHONE.—A bitter quarrel has occurred in the Holmes and Tuscarawas Counties (Ohio) colonies of the Amish people, which threatens to disrupt the congregations. The disturbing element is the telephone. The Amish regard all new-fangled notions as immoral. The members of the sect never have their photographs taken, and hooks and eyes are used in their clothing instead of buttons, it being held that buttons are ornamental and not in keeping with the discipline of the church. The younger Amish men are losing faith in some of these beliefs, and when a telephone system was introduced in their district a number of them became subscribers. When the news became noised abroad there was an uproar which startled the quiet communities. The elders called together the congregations and forbade any member to have a telephone in his or her home. Telephones which had been installed were ordered taken out, and any one using the instrument is to be expelled from the church forthwith. The progressive young members declare they will not dispense with the modern convenience, and unless some amicable agreement is speedily reached there will be a permanent split in the church organization.

TELEPHONE WHILE YOU TROLLEY.—The cars of the St. Louis, St. Charles & Western Railroad, a suburban electric line running out of St. Louis, are being equipped with telephone instruments

and fishpole connectors for connection with the telephone line wire anywhere along the road.

PROTECTING THE POOR BOX.—At Minneapolis, Father G. André, of the Church of Notre Dame de Lourdes, noticing that the poor box in the church was being robbed, had it fitted with a burglar alarm. When this rang he dashed into the church and out into the street in pursuit of the thief. The priest finally overtook the man and handed him over to the police. He was a cigarmaker. An hour later he was found hanging in his cell, dead. This use of the burglar alarm ought to be pushed.

SUBMARINE BOATS.—The French are enthusiastic on the subjest of submarine boats, and are greatly elated over the discovery of Messrs. Desgrey and Balthazard that air in confined places may be renewed and purified by the use of sodium bioxide. The sodium bioxide absorbs carbonic acid gas and gives off oxygen in exchange. A diving helmet has also been devised of aluminum, coated with sodium bioxide, which enabled the wearer to remain for several hours in an atmosphere which he could not otherwise have breathed. The value of the discovery as regards submarine navigation lies in the fact that it is expected to obviate the necessity at present existing of storing air at high pressure on a vessel under water, and thus save valuable space.

YUKON TELEGRAPHS.—Advices from Dawson say that steamers just in from St. Michael bring word that the United States telegraph system in the Yukon will be completed from Nome to Tanana by Christmas. The line from Dawson northward to Eagle, on the American side, will be concluded a month hence. Dawson and the outside world will be connected in less than two months. So, by Christmas, the only stretch between Eagle and Tanana will remain to be built. That stretch is 800 miles long. The telegraph constructors of the United States line are scattered along the Yukon in numerous crews. One or more crews were seen daily by steamers coming up the river.

COMSTOCK LODE POWER TRANSMISSION.—The formal celebration of the turning on of electric power at the Comstock Lode took place Oct. 20 in Virginia City, Nev. The Gould & Curry mill had been in operation on a test run for some days, and it was there that the invited guests from San Francisco witnessed the ceremonies. The distance of electric transmission is 33 miles. Mrs. Davis, the daughter of Superintendent Kinkead, broke a bottle of champagne, and after pouring its contents into the ore crushers, switched on the electric current, which started up the machinery of the Gould & Curry mill.

ELECTROLYTIC LIGHTNING ARRESTERS are the subject of a patent issued last week to Mr. Charles J. Reed, the electrical engineer, of Philadelphia. One or more electrolytic cells are used, although the drawings show each arrester with a plurality of cells arranged in series. Since discharges of atmospheric electricity are alternating in character, they will pass easily through the electrolytic cells without setting up a counter e. m. f. of polarization therein, while the current from the generator (direct current or large rotary transformers being specially considered) being unidirectional, will not follow the arc formed by the static discharge without producing almost instantly a counter e. m. f. of polarization that is sufficient to effectually stop the flow of current from the generator to ground. The number of cells in the series should be sufficient to give a counter e. m. f. either equal to or greater than the e. m. f. of the generator. This counter e. m. f. of polarization affords perfect security against the passage of current from the generator to ground, and thus enables Mr. Reed to use a special form of spark-gap which would not otherwise be feasible. A special spark-gap of tubular construction and zigzag or helical interior structure is shown.

STORAGE BATTERY PLATE.—Mr. E. A. Sperry, of Cleveland, has taken out a patent on a storage battery of the alkali type. He takes the oxide or mixture of oxides of lead and intimately mixes therewith the salt constituents consisting of sulphate and phosphate of one or more of the alkali bases, potassium or ammonium preferred. This mixture is then moistened with distilled water and is mixed with finely-divided metallic lead—such, for example, as precipitated lead, which after precipitation should be kept in a suitable vessel under water until used. The mixture is diluted until it reaches the consistency of thick dough, and while being vigorously stirred there is added a solution of hydroxide of an alkali metal—such, for instance, as liquid ammonia diluted to from three-fifths to one-fourth with distilled water. When the mass has been thus thinned down to a condition which permits it to be readily spread over a conducting plate or grid, it will be found to have the property of setting peculiar to cement. It is then applied in any convenient manner to the plate or grid and caused to adhere thereto as a closely-coherent mass compacted by pressure in a mold. The mold consists of a heavy separable steel frame adapted to contain a retaining grid or support. When the plate or grid, with an attached mass of the composition, is placed in the mold, it is immediately subjected to heavy pressure in a suitable press, after which it is removed from the mold and set on edge to dry. Mr. Sperry has found that the open air or the sun's heat is the best means of drying, and that the heavy toggle-press is more suitable than the hydraulic press for this work on account of the more rapid action and the quickness with which the maximum pressures are reached, while with a press of sufficient capacity the final pressures are equal to those obtained in the hydraulic press. When dry, the plates, by the action of an electric current in a suitable bath, are "formed," after which they are grouped and charged in the well-known manner to bring the alternate plates or groups to opposite polarities and render them ready for use. Mr. Sperry states that very serviceable plates may be produced by the use of from 80 to 85 per cent of finely-divided lead, from 15 to 20 per cent of the oxide of lead, and an admixture of a salt, such as sulphate of ammonium, amounting to about one twenty-fifth of the whole mass.

MANUFACTURE OF REFLECTORS.—Mr. S. O. Cowper-Coles, of London, England, has taken out a patent on the manufacture of reflectors in this country. The present invention consists in the employment of molds of speculum metal instead of the glass molds heretofore used, thus enabling a highly-polished, truly-shaped and electrically-conductive surface to be obtained without the special treatment necessary where glass is used. A further feature consists in the application of a reflecting and protecting surface of platinum to the electrically-deposited reflector. The speculum metal is cast in an iron mold heated almost to the melting point of the said metal, which may consist of tin, 15 parts; copper, 32 parts, and arsenic, one part; or tin, one part, and copper, two parts. This metal is poured carefully into the mold through a central feed opening or runner, so as to insure a sound casting free from blow-holes, the edge of the mold being left open. The casting is then removed from the mold and is brought to the true geometrical shape required for the finished mold, after which it is provided with as high a polish as possible. It is then coated with a thin film of beeswax dissolved in a suitable solvent to facilitate the removal of the mirror from the mold. This film of wax is so thin that it does not act as an insulator to the mold and does not therefore require metallizing. The body of the reflector is then electrically deposited on the mold in one or more layers, the surface next to the mold acquiring a highly polished and true surface corresponding to that of the mold. When the deposition has been carried on to the required extent, it is stopped and the reflector backing and mold are detached from one another, which may be readily done by heating them slightly, by dipping in hot water, when the difference in expansibility will cause them to separate. That surface of the reflector which was adjacent to the mold is then cleaned chemically—for example, with a solution of potassium cyanide or hydrate—and the reflecting and protecting surface of p'atinum, palladium or chromium is applied to it by means of electrical deposition. The bath used for the electro-deposition of the platinum may be composed of freshly precipitated double chloride of platinum and ammonium dissolved in a boiling concentrated solution of neutral citrate of sodium. The solution is used in the cold state and should contain about 1½ ounces of metal to the gallon. The current should have a density of about three amperes per square foot of cathode surface, and the difference of potential between the terminals of the depositing cell should be about 0.75 of a volt.

CHICAGO CITY OWNERSHIP.—The bills which the Municipal Street Railway Commission proposes to introduce at the coming session of the State Legislature as the result of several months exhaustive study of the traction situation, are practically completed. The first measure will be one conferring upon the city authorities the specific right to own and operate street railways. The city will be empowered to negotiate for the purchase of the present street railway plants within city limits or to build an entirely new system. Before

bonds can be issued, the question must be submitted to a vote of the people. The second measure provides for municipal ownership of a comprehensive system of down-town subways. It proposes to confer authority upon the municipality to build subways on a bond issue, and, like the other bill, makes an affirmative popular vote necessary before such bonded debt can be incurred. The net result of the Municipal Street Railway Commission's labor is thus the adoption of the principle of municipal ownership and of the referendum system. On the other hand, three well-known Roman Catholic clergymen have issued a pamphlet in which they say: "For the city to own and operate the roads now is simply out of the question. At this time, for obvious reasons, it would be a most dangerous experiment. Thirty-five or fifty years hence, when civil service will have become thoroughly and universally recognized and practiced by our public servants, it might be wise to do so, but not now. In addition to these inherent objections to municipal ownership, there is still another. This is the ninety-nine-year franchise given the roads by the Legislature in 1867. That franchise may be valid or not, but at all events it would give the companies a leverage which they very naturally would use to prevent their being ousted from the streets. This would result in long, vexatious and expensive litigation, and in the end the city might be defeated."

LETTERS TO THE EDITORS.

Irregularities in the Paris Awards

To the Editors of Electrical World and Engineer:

Sirs:—Had you been more fully informed in regard to the work of the jury in Group 5 (Electricity), at the Exposition of 1900, you would not have published the editorial "Also Ran" in your issue of Sept. 29. That editorial, although it does not name me, puts me too much in evidence, and would leave a wrong impression on the minds of my friends in America if I did not protest warmly against its inexactitude; not against the fact recited—for it is true—but against your interpretation of that fact. Permit me to give an official version of the incident:

The Committee of Admission in Group 5, of which I had the honor to be a member, decided on my demand but against my wishes, that publications, reviews and journals should not be admitted to the Exposition. At that time I wished to exhibit my books and *L'Industrie Electrique*; and my friends and colleagues Blondin, *L'Eclairage Electrique*, and Montpellier, *L'Electricien*. When they were informed of this decision, none of my colleagues took any further action, and the French electrical press was not represented at the Exposition. It was under these circumstances that, in the jury of the group, I fought against any award being given to *any* journal in that group. Had I done otherwise, I should have betrayed the interests of my French colleagues whom a ruling taken against my wish hindered from exhibiting.

There was not, then, as the author of the editorial seems to think, any question of show space or individual, but simply a question of equality before the jury. We could not justly concede that journals from some countries were entitled to awards in a group where the journals of other countries had been excluded.

The ELECTRICAL WORLD AND ENGINEER is the leading electrical journal of the world. America is a hospitable country where we were received most cordially in 1893. We propose visiting it again next year on the occasion of the Pan-American Exposition at Buffalo, and we should be sorry to find that a cloud had been thrown over our pleasant American relationships by an editorial the author of which has been ill-informed. E. HOSPITALIER,

(Reporter, Committee of Admission, Committee of Installation, and member of Class 23, Exposition, 1900.)

[We regret exceedingly to have nothing to change in our editorial, but in fairness to Prof. Hospitalier we print his highly appreciated explanation. Having, in spite of this unannounced intention to exclude electrical papers, made a large authorized exhibit, and having received three Grand Prizes and a Silver Medal, it would obviously be very ungracious for the company publishing this journal to complain against the action which, utterly unknown to us, Mr. Hospitalier says was taken upon his demand. In no other group whatever, so far as we can ascertain, was such action taken publicly or privately. The jury did not begin its work until three months after our exhibit had actually been fitted up in Electricity Building, and one year after its name had appeared in the official lists; while it has been published in its class in all the catalogues. The author of the editorial met Mr. Hospitalier in Electricity Building at the beginning of June, communicated to him the names of the American jurors, and invited him to visit the exhibit. Prof. Blondin was amiable enough to visit the exhibit with the author of the editorial, and took away with him one of our book publications as a souvenir of his courteous call at the space. Neither gentleman said one single word about this discrimination against the electrical press, either as to exhibiting or as to awards. Other technical journals from America and elsewhere have received awards in their specific groups—we could name several—and not a word implying exception in our case was said to us by the U. S. Exposition authorities. We are necessarily still at a loss to comprehend why an unpublished, unissued ruling of which the French authorities have never yet advised us in any way, shape or form, was made against American journals in Electricity Building. The mystery of the whole business remains, how, if such conditions really were in force we were allowed to go to very serious trouble and expense in Electricity Building. But we have published no complaint, and in view of the lavish honors loaded on us outside Mr. Hospitalier's jurisdiction, as recited above, the matter can hardly possess even an academic interest for anybody. We trust therefore that our readers will forgive us for noting this trivial matter, and hasten to assure our esteemed colleague that he need not have the least alarm as to the warmth of American welcome for European friends next year, or any year.—EDS. E. W. AND E.]

Double Overhead Trolleys and Electrolysis.

To the Editors of Electrical World and Engineer:

Sirs:—In your issue of Oct. 13, page 582, a writer in discussing the example of the Cincinnati double trolley, wherein one wire conveys the outgoing and the other the return current for the avoidance of electrolysis consequent upon returning the current by the rails and earth conduction, makes the pat remark that "better far than this nightmare, to provide the ordinary trolley with an underground insulated return, connected permanently to a series of surface contact studs on the track," which, he concludes, has never been tried. Please permit the correction by setting forth the fact that in an application allowed nearly six months ago, which will be issued in a few days, provision is made not only for the return current by the stud or stand system, but also for the outgoing or positive current, thus doing away entirely with the overhead wires. These positive and negative stands are situated far enough from each other so that animals could not reach from one to the other were they live, but they are alike "dead" the instant the car passes over them. This is accomplished by an inexpensive, and invariable in action, waterproof combination that renders accidents from live wires absolutely impossible. It is cheaper than the trolley system, and requires no repairs. The system has been fully demonstrated, and is to be known as the Osborn courier in relay electric railway system. It has been invented by Major and Surgeon B. E. Osborn, formerly of the U. S. Army, of Auburn, N. Y. C. F. PARCELLS.

AUBURN, N. Y.

[Stud contact systems generically are by no means new.—EDS. E. W. AND E.]

Progress in Incandescent Lamps Abroad.

To the Editors of Electrical World and Engineer:

Sirs:—Referring to your editorial of Sept. 22, and comments on progress of incandescent lamps abroad given by M. Blondel in a paper read by him before the recent Paris Congress, I would like to comment as follows: American makers have already imported a number of the 10 and 12c. 16-cp 100-volt lamps, described by M. Blondel as good, and put them on competitive tests with American makes. The results given by such lamps showed a marked inferiority to the best American makes. They would be dear at one-half the price at which they are sold, as compared with the best American makes at 20c. each. Incandescent lamps abroad are sold by the test of *price*, and in this country by the test of *quality*. In Europe any lamp is good enough if it is cheap enough; in this country the best lamp is none too good at any price within limits.

The reason for this lies in the different practices followed in the supply of lamps. The European companies follow the pernicious practice of compelling their customers to buy and supply their own

lamps, while in this country, as a rule, the lamps are supplied by the central stations. Where customers supply their own lamps, depreciated lighting invariably results. This is so primarily because it is impossible to educate the customer on the essentials of a good lamp—he is too numerous and he is not technical enough to comprehend.

In his ignorance the customer assumes those lamps the best that are cheapest and last the longest. Thus arises the demand for cheap lamps, and we see at once why foreign lamps are so low in price and poor in efficiency (long-lived lamps are necessarily low in efficiency).

Again, the lamps are purchased, not from the manufacturer, but from supply houses who are interested solely in the sale and not in the service of the lamp. They supply, therefore, the lamp that will give the least trouble, i. e., a long-lived, low-efficiency lamp. Thus between the ignorance of the customer and the indifference of the supply houses the general results are:

1st. The manufacturers have no incentive to produce high-grade lamps, but are compelled by conditions of trade to produce those lamps that they can sell cheapest, and will give the longest life; two conditions that produce the poorest quality of lamp.

2d. The central stations suffers in being unable to improve its lighting service, which the customer depreciates by his selection and use of cheap and inferior lamps.

3d. The customer suffers in very poor lighting results through his ignorance of what constitutes lamp quality, and in the end pays more for his lamps and light than he would were the lighting company to select and supply, as they intelligently can, the type of lamp best suited to his needs.

The opposite practice (followed in the United States) by which the central station supplies the lamps, results in a demand for the highest quality of lamp—the full-priced, high-efficiency lamp. It insures the use of the best type of lamp, as every central station manager can be educated to an appreciation of the best. It insures the renewal of the old and dim lamps, as the central station owns the lamps and can replace them at will.

The general result of all these conditions is that the average efficiency of incandescent lamps used abroad is much lower than that of lamps used in this country. The average is about 4 watts per candle, while in this country the average of the leading central stations is 3.1 watts per candle, and of all stations not lower than 3.5 watts per candle, 4 watts per candle being used only in exceptional cases.

This statement is made on the basis of a common standard of candle-power. European lamps are generally rated by Hefner standard, and a 16-cp lamp on this standard is only 14 candles by the English Parliamentary standard used in this country. This would result in the so-called 3.1-watt European standard being really by the American standard 3.5 watts per candle. All tests that have been made on the European high-efficiency 2.5 and 3-watt lamps show them to be so only by the rating of the Hefner low candle-power standard.

The opinion of American engineers, who have studied the lighting conditions abroad, is that the electric lighting service on the Continent is miserable, and one can safely predict that it will always remain inferior to that given in this country so long as the practice is continued of compelling customers to supply their own lamps.

HARRISON, N. J. F. W. WILLCOX.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

By CARL HERING.

DYNAMOS, MOTORS AND TRANSFORMERS.

Induction Motors as Generators.—LEBLANC.—A continuation of his illustrated paper "On the transmission and distribution of energy by arternating currents" (Digest, Oct. 27). He discusses the services which an induction motor is able to render when employed as a generator. It is possible to couple single-phase alternating induction machines, with closed circuits, in parallel, and branch them upon the distributing network; they will be able to furnish the whole of the effective currents required for the service of the network, but all wattless currents required for the same service or for the excitation of the induction machines must be furnished by a special source of e. m. f. It is also possible to couple the same machines in series in a circuit; they will be able to develop all those e. m. fs. which are of the same phase as the current, but all those in quadrature must be generated by a special source. In both cases the induction machines need not turn synchronously; they would be coupled like direct current machines; the one which turns the fastest will absorb the most mechanical energy. These conclusions have been verified in the workshops of the Paris firm at Farcot and at the works of St. Ouen. In order that an induction machine may always be used as a generator, it is necessary that instead of taking the wattless current required for its own excitation from a primary source, it should be capable of generating them itself, so that the currents required, effective or wattless, by the distribution service, may be provided by it. For this it is necessary that the difference between the products of the coefficients of self-induction of the primary and secondary circuits, and the square of the maximum value of the coefficient of mutual induction between the primary and the secondary circuits, should be negative. This condition will never be fulfiled in an induction machine with circuits closed on themselves, for the difference is always positive, and only becomes zero in a perfect machine. To fulfill this condition, one of the coefficients of self-induction must be artificially diminished; it is most convenient to do this for the secondary; for this purpose it is necessary to add to the circuit an apparatus capable of furnishing a part of the apparent energy necessary in order to pass a given alternating current through it. The paper is to be continued.—Lond. *Elec. Rev.*, Oct. 12.

Transformer Core Ageing.—GOLDSBOROUGH.—A paper giving an account of core ageing tests on five modern representative transformers during two years. The conditions of the tests are described and the results are given in a table. In two transformers the core loss values decreased, the decrease of loss being over 10 per cent in one case. In two others the losses remained about equal. In the fifth, the core loss increased by 4 per cent. The variations in the ageing results are, to some degree, dependent upon the temperature variations which existed in the iron of the transformer core at the time when tests were made. There is, however, also an actual change in the condition of the iron which is independent of the temperature variations. Iron actually improves with age, provided its initial treatment has been such as to bring about this effect; such iron, however, has a greater initial hysteresis loss than it would have if the treatment were varied in such a way as to reduce its initial loss. He does not know what the previous treatment of the core iron of the five transformers tested was.—*Elec. Rev.*, Oct. 17.

Large Tramway Generators.—PARSHALL.—An article on the design of large tramway generators. He fixes in advance an efficiency of 94 to 95 per cent and locates the losses in accordance with the best established practice. From the temperature rise per watt per square inch, as found in practice, and the permissible increase of temperature, the surface of the different parts for a given output is determined by the energy loss. The surface is given by two dimensions so that if one of these dimensions can be determined by some other feature, the other dimension is readily obtainable. These dimensions are determined with respect to the "magnetic limit" of output and particularly with respect to the self-induction and the maximum current output per pole consistent with the proper thermal conditions with highest efficiency. He limits the discussion particularly to that of a single type of dynamo, in which the speed and all other conditions are the most favorable to highest efficiency. He gives the data for a 550-kw Gen. Elec. dynamo.—*St. R'y Jour.*, Oct. 13, and Int. Ed., Oct.

Railway Motors.—LUNDIE.—An article on the electric railway motors, in which he first discusses the most economical method of acceleration and braking, which is, to accelerate rapidly to a given speed, then coasting until it is time to brake from the low speed which the train has reached. The maximum power is demanded for the period of acceleration. The adhesion between the driving wheels and the rails which may be estimated at the rate of 15 per cent of the weight on the drivers, determines the maximum permissible current. It is usual to allow a temperature rise of 75 degs. C. above the atmosphere, but the field coils should not be allowed to reach the maximum tem-

perature, which should be confined to the armature. He discusses a method of rating the horse-power of railway motors, which under actual conditions of operation on frequently intermittent loads, should be proportional to the average current input independently of the variations in the current, except as the current may be governed by the limitations of satisfying commutation. He gives the results of tests of railway motors in diagrams, showing the temperatures obtained by the field and armature under intermittent loads.—*St. R'y Jour.*, Oct. 13, and Int. Ed., Oct.

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Converters and Rectifying Transformers.—Janet.—A translation of his Internat. Elec. Cong. paper in full, which was abstracted in the Elec. World and Eng., Sept. 22, p. 449.—*West. Elec.*, Oct. 13.

Excitation of Induction Machines.—Leblanc.—A long abstract of his Internat. Elec. Cong. paper, which was abstracted in the Elec. World and Eng. Sept. 15, p. 411.—*West. Elec.*, Oct. 13.

Equivalent Air-Gap.—Guilbert.—A translation of his French paper on "The apparent increase in the air-gap of dynamos and motors due to toothed armatures," which was abstracted in the Digest Oct. 27.—*Elec. Rev.*, Oct. 10.

Lights and Lighting.

REFERENCE.

Continuous Current Arc.—Mrs. Ayrton.—The first part of an illustrated reprint in full of her Int. Elec. Cong. paper, on the light emitted by the continuous current arc, which was abstracted in the Elec. World and Eng. Sept. 15, p. 410. The paper is also discussed in an editorial.—Lond. *Elec.*, Oct. 12.

Power.

Electricity for Agriculture.—Walsh.—An article on the application of electricity to agriculture. In California and the great grain fields of the Northwest electric automobiles and harvesters are actually in operation, and there are a few modern farms where the power of a stream flowing through the land has been utilized for generating electricity for lighting purposes and for running farm machinery. Attention is also called to the fact that the stored waters of the great Western rivers are now solely used for watering the farms in the summer, while they could be used besides for generating electric power. He then gives an account of experiments which have been made to use electricity for stimulating the growth of plants, especially at Cornell University by the use of arc light during the night, which has a peculiar influence upon plants and flowers.—*Elec. Rev.*, Oct. 10.

Electric Sawmill.—An illustrated article on a 35-hp motor directly connected to a sawmill. The speed of the saw is 800 r. p. m. The motor is heavily overcompounded. The normal rating is 135 amp. at at 220 volts; when not cutting, but driving the blower, the minimum current is 30 to 35 amp.; when taking a cut, the current is constantly and rapidly varying from 50 to 240 amp.; notwithstanding the unusual demands, the motors works without extra attention.—*West. Elec.*, Oct. 13.

REFERENCES.

Thury System.—Perkins.—A brief illustrated article on the electric plant for transmitting power from Isoverda to Genoa, and another transmission between Chaux-de-Fonds and Locle, in which Thury's direct-current high-tension series system is used—*Jour. of Elec.*, September.

Water Power on the Pacific Coast.—Hunt.—A brief article on electric power transmission on the Pacific Coast, where there is already utilized, or in process of construction, a capacity approximating 50,000 horse-power; in addition to this, numerous projects are under consideration. Several plants are briefly mentioned.—*West. Elec.*, Oct. 13.

Niagara.—Perkins.—An illustrated article on the preparations which are being made at Niagara to supply additional power for use at the Pan-American Exposition at Buffalo next year, for which purpose 5000 horse-power will be needed.—*El'ty*, Oct. 17.

Water Power Plant of Chevres.—The first part of a long illustrated description of this plant, where a fall of the Rhone River is utilized for generation of electric power for distribution for all purposes in the Canton of Geneva, Switzerland. The power available at times of low water is 10,560 horse-power. An historical outline of the undertaking is given. Each of the generator sets has a minimum output of 1000 horse-power each and consists of one large double turbine and an alternator mounted on the same shaft. The exciter sets consist of similar turbines with exciters, their output being 150 horse-power.—Lond. *Elec. Rev.*, Oct. 12.

Canadian Water Power Plant.—A description of the Lachine Rapids electrical transmission plant, which contains 12 three-phase generators, giving 750 kilowatts at 175 revolutions, the frequency being 60, the voltage 4400. The power is transmitted to Montreal for lighting and power purposes.—*Can. Elec. News*, October.

Steam Turbine.—An illustration of one of the 1000-kw Parsons steam turbine alternators in the central station of Elberfeld, Germany, with some remarks on the tests, which were already noticed in the Digest Sept. 8.—Lond. *Elec. Rev.*, Oct. 12.

Electricity in Mines.—Perkins.—An illustrated article on mining machinery and locomotives.—*El'ty*, Oct. 10.

Electric Installation of Mines.—Adams.—An article recommending the use of a three-phase alternating-current system for distribution to mines, with step-down transformers for supplying the lighting circuits, induction motors for power purposes, and synchronous converters for supplying the current for traction.—*West. Elec.*, Oct. 20.

Traction.

Energy Consumption of Tramways.—Sieber.—An article, in which he gives a formula for the average energy consumption on electric tramways, which appears as the sum of four parts, the first depending upon the motor-car miles, the second upon the traction resistance, the third upon the number of stopping places and the number and length of curves, the fourth upon the grades. He shows in a special example how different may be the influence of the grades. His formula appears too complicated to be reproduced here; he recommends, however, to use it in making a tramway project. In conclusion, he gives the numerical data of the constant in his formula for cars with two motors and one motor.—*Elek Zeit.*, Oct. 4.

Automobile Tests.—A note giving a programme for competitive tests of electric motor cars, to be held by the Automobile Club of London in November. The following trials will be made: A run over a given course for an unlimited distance on one charge, the driver to declare to the official observer when the run is to be considered as finished; a course of 30 miles, to include considerable gradients; a course of 30 miles of average road; a course of 30 miles of flat or nearly flat road; the energy consumed, number of passengers and average speed will be recorded, but no speed in excess of the legal limit of 12 miles per hour will be recognized.—Lond. *Elec.*, Oct. 12.

REFERENCES.

Polyphase Traction.—Bignami.—An illustrated article on the electric equipment of the Lecco, Sondrio & Chiavenna line, in course of erection in Northern Italy, with a three-phase system, using 20,000 volts for transmission and transformer sub-stations, reducing the voltage to 3000, at which pressure the current is supplied by the trolley to induction motors on the locomotives, as described in the Digest April 7 and June 30.—*Elec. Rev.*, Oct. 10. The English article by E. K. Scott, abstracted in the Digest June 30, is reprinted in *Jour. of Elec.*, September.

Burgdorf-Thun Polyphase Railway.—Rung.—The first part of an illustrated description of this polyphase electric railway, which has been noticed repeatedly in the Digest.—*Ingenioeren* (Denmark); translated in Lond. *Elec. Rev.*, Oct. 12.

Third-Rail System.—An illustrated description of the Albany & Hudson electric railway, on which the third-rail system is used.—*Elec. Rev.*, Oct. 17.

Glasgow.—An illustrated article on the electric equipment of the tramway system of Glasgow, Scotland, which was mentioned before in the Digest.—*Tramway and R'y World;* reprinted in *Elec. Rev.*, Oct. 10, 17.

Kansas City.—A long, illustrated article on the Metropolitan St. R'y system of Kansas City; also illustrated articles on the East Side Elec. R'y of that city and of the Kansas City-Leavenworth electric railway.—*West. Elec.*, Oct. 20.

Twenty-Ton Automobile.—A brief illustrated description of a heavy electric automobile, used in Paris by a sugar refinery for the transportation and delivery of water. Unloaded, but with its battery, it weighs 11 tons and is capable of carrying a load of 9 tons. The battery consists of 80 Phœnix cells and has a sufficient capacity for a run of 25 miles.—*Elec. Rev.*, Oct. 10.

Automobile.—An illustrated article on the use of the automobile in modern warfare.—*Sc. Amer. Sup.*, Oct. 13.

INSTALLATIONS. SYSTEMS AND APPLIANCES.

Single-Phase Alternating-Current Supply.—A note saying that "Sheffield has had full opportunity to discover the disadvantages of a single-phase alternating-current system for general supply purposes." A year ago a change-over to direct current in the central supply area had been advised, but the scheme was abandoned. Now it has been proposed to retain the single-phase system and reduce the frequency from 100 to 50, but no definite conclusion has been reached; the residing engineer is now visiting Paris, Frankfort and Nuremburg to study the question.—Lond. *Elec.*, Oct. 12.

REFERENCES.

Switchboard.—An illustrated description of the new 16-panel switchboard for the alternating output of the plant at London, Ont, which has two 300-kw and two 120-kw single-phase alternators.—*Can. Elec. News*, October.

WIRES, WIRING AND CONDUITS.

India-Rubber.—TERRY.—An article on the action of water upon india-rubber. That water passes through pure or unvulcanized rubber at ordinary atmospheric pressure to an appreciable extent, was demonstrated long ago by Hancock, who made a test extending over 30 years. With vulcanized rubber the case is quite different and at ordinary pressures it may be considered as almost impervious to water unless it is extremely attenuated; increased pressures, however, tend to increase the amount of water which rubber absorbs. He questions whether the action of water upon rubber is entirely physical or whether it induces any chemical change in the material; as far as known with any certainty, the change can only be described as a physical one, the effects being increase of bulk and diminution of adhesiveness and tenacity. The fact that absorption of water takes place to some extent in vulcanized rubber should not be ignored by those who propose to place vulcanized rubber cables in water. It may be that the idea that vulcanized rubber is unsuitable for deep sea cables, originated in the fact that some of the earlier rubber cables proved unsatisfactory; perhaps opponents of rubber for this purpose have not paid sufficient attention to the results which have been obtained by improvements in rubber insulation. A case of a vulcanized rubber cable is quoted which was laid 25 years ago in 2000 fathoms of water and is now in perfect condition. In referring to the action of water upon rubber, it is, however, always necessary to be explicit as to the nature of the rubber, whether highly compounded or not, because the composition of the rubber may have a profound influence in determining its capacity for absorption.—Lond. *Elec.*, Oct. 12.

Faults in Cables.—WRIGHT.—An illustrated article in which he describes "some interesting faults met with in cable manufacture" and discusses how to prevent them. In rubber and gutta-percha insulated wires and cables the faults most commonly met with are due to foreign matter and impurities in the insulating medium, such as wood, fibre, dirt, splinters of metal, mineral matter, etc. Sometimes the conductor is out of centre, so that the insulation is very thin on one side and correspondingly thick on the other. A frequent cause of local weakness in insulation is the absence of pure rubber at certain points along the core. A very common fault met with in vulcanized rubber-covered cables is that caused by a flattening of the insulating sheath due to excessive pressure while in a plastic state. The taping previous to vulcanization is also frequently responsible for certain faults. Broken wires and strands are a constant source of trouble; another form of fault is a "bird-caged" strand. Lead sheathing is also responsible for several faults.—Lond. *Elec. Rev.*, Oct. 12.

REFERENCES.

Joints for Concentric Cables.—ANDREWS.—An article stating that while a service joint box for a triple-concentric cable costs from $10 to $16, in Hastings a joint box has been used for some time with good success, which only cost $5, one jointer being able to connect on as many as eight to ten services in a day. Photographs are given showing the different steps in connecting a concentric service onto a triple-concentric; the total time in making this particular joint was 33½ minutes.—Lond. *Elec. Rev.*, Oct. 12.

Interior Wiring.—ALLINGHAM.—A reprint of the English article, abstracted in the Digest Oct. 20.—*El'ty*, Oct. 17.

Interior Wiring.—HERTNER.—An article in which he develops, in an elementary manner, the principles of interior wiring.—*The Eng.*, Oct 15.

Cable Insulation.—WRIGHT.—A reprint of his article on "The ethics of insulating materials," noticed in the Digest Oct. 13.—*El'ty*, Oct. 10.

ELECTRO-PHYSICS AND MAGNETISM.

Skin Effect.—HOPPS.—A paper on "The so-called skin effect, or the increased resistance of iron wires to alternating currents." He gives in a table the results of tests made on straight lengths of iron wires and rods of ordinary commercial value, from various manufacturers; an observed current was passed through the rod, the drop in volts due to a known length being measured by means of a low-reading hot wire voltmeter. He gives in diagrams curves for the specific impedance for varying diameters and for varying periodicities. It appears that the resistance offered to currents of 100 cycles per second by rods of 0.975 in. diameter is, roughly, 16 times that offered to direct current, this value decreasing with the smaller diameters of rods to only 1.4 times for a wire 0.105 in. diameter. Further, there is corresponding to each periodicity a certain value for the apparent resistance per unit length below which it cannot be decreased by further increase of the diameter of the rod; for instance, for 100 cycles, no increase of diameter will reduce the apparent resistance per inch length below 100 microhms per cubic inch.—Lond. *Elec.*, Oct. 12.

Temperature in an Electric Conductor.—WIMPERIS.—An article, illustrated by diagrams, on the stability of temperature in an electric conductor. When a small part of a wire, supplied with a constant current, is raised to a higher temperature, say by a flame, the resistance is increased and therefore the Joulean heat is increased, which tends to raise the temperature still further. The principal phenomenon opposing this rise of temperature, is the increased radiation from the wire. Whether the temperature will rise or fall on the flame being removed depends upon which is greater, the increase of heat owing to increase in resistance or the decrease of heat due to the increased radiation. He plots curves for the change of heat due to radiation and for the change of heat due to changed resistance, with the temperature as abscissas and the heat change as ordinates. The point of intersection of both curves represents a point of equilibrium; this is a stable equilibrium, if the slope of the radiation curve is greater than the slope of the resistance curve; this is always the case in practice. He describes briefly some experiments which he made. —Lond. *Elec.*, Oct. 12.

Phosphorescent Glow in Gases.—BURKE.—An abstract of a Brit-Ass'n paper, in which he gives an account of experiments in which he has investigated the phosphorescent glow that is produced when an electrodeless or ring discharge is sent through some rarefied gases. The phosphorescence is due to molecules which do not carry a charge of electricity, but which nevertheless produce conductivity as they move through a gas, and at the same time are rapidly broken up or destroyed in the ionized gas.—Lond. *Elec.*, Oct. 12.

Cathode Rays.—MERRITT and STEWART.—A long paper on "The development of cathode rays by ultra-violet light." They give an account of a series of experiments which show that the photo-electric rays, like cathode rays, are deflected in passing through a magnetic field; they render the air through which they pass conducting; in all probability they are deflected by electrostatic forces. They conclude that the photo-electric rays are identical in character with ordinary cathode rays.—*Phys. Rev.*, October.

Thermo-Magnetic Phenomena.—MOREAU.—A paper in which he shows that the Hall effect and the Nernst effect are in reality identical, by proving that the one follows from the other and that their coefficients are of the same order and sign. He gives a theory of the connection between the two phenomena and an account of experiments which he has made. In steel, iron, cobalt and nickel, the Hall and Nernst effects are both proportional to the magnetization of the plate, and their reversal occurs about at the same temperature.—*Jour. de Phys.*, September; abstracted in Lond. *Elec.*, Oct. 12.

Sparkless Magnet Coils.—ASHER.—An article in which he describes briefly eight different methods of winding electromagnets in order that sparking at the contact maker may be entirely suppressed or greatly diminished. The first method is to wind two insulated wires of the same kind and length as one strand on the bobbin throughout their entire length; the two ends of one of these wires are firmly fastened together; the two ends of the other wire are connected with the contact maker and the battery in the usual way; the mutual induction of both circuits presents sparking. The others. with one exception, are not new.—*Can. Elec. News*, October.

REFERENCES.

Electric Waves.—BARTON and LOWNDS.—A reprint in full of their Brit. Phys. Soc. paper on the "Reflection and transmission by condensers of electric waves along wires," abstracts of which were noticed in the Digest March 3. The first part of the paper gives the theory of the subject, based upon that of Heaviside. In the second part they describe their experiments, which were found to be in agreement with the theory.—*Phil. Mag.*, October.

Condensers.—BOUCHEROT.—A translation in abstract of his Internat. Elec. Cong. paper on the use of condensers, which was abstracted in the ELEC. WORLD AND ENG. Sept. 22, p. 450.—Lond. *Elec.*, Oct. 12.

Cathode Rays.—STARKE.—An account of an experimental investigation of the diffused reflection of cathode rays, especially with copper and aluminum mirrors.—*Ann. der Physik.*, No. 9; abstracted in Lond. *Elec.*, Oct. 5.

Ions.—An article on several points in the recent Brit. Ass'n discussion on ions, atoms and electrons (Digest, Oct. 20).—Lond. *Elec. Rev.*, Oct. 5.

ELECTRO-CHEMISTRY AND BATTERIES.

Leclanche Cell.—SOULIER.—A description of a new type of the Leclanche cell. The electrodes have a great surface, the zinc is used as the jar of the cell. The carbon plate is covered with a mixture of peroxide of manganese and graphite. The electrolyte is made semi-solid with "gelosine." Besides this kind of cell, the so-called "bag" type has been made, the internal resistance of which is still smaller. Half-cylinders of a depolarizer are formed under high pressure with manganese as a base, and the purest natural graphite. Two of these half-cylinders are placed in a linen bag, and between them is forced a carbon rod. No stringing is necessary, as the two half-cylinders tighten the bag sufficiently. The whole is a cylindrical block, the cohesion of which increases when immersed into the exciting liquid. Cells of this type give 25 to 30 amp. on short circuit. In a diagram he gives three curves which show the variations of the voltage if the cell is discharged through 20 or 10 to 5 ohms respectively; at the beginning of the discharge the voltage is 1.5 for all three curves, after 10 days it is 1.36, 1.28, 0.9 respectively, after 20 days 1.3, 1.02, 0.66, after 33 days 1.25, 0.82, 0.45; the ampere-hours given in the three cases are 52.5, 87.9, 127.6. The weight is not given.—*L'Ind. Elec.*, Sept. 25.

Hydrolysis of Ferric Chloride.—GOODWIN and GROVER.—A paper in which they give an account of experiments on the effect of temperature, of colloidal ferric hydrate, and of a magnetic field, on the hydrolysis of ferric chloride. While chemical reactions may in certain cases be modified when they are caused to take place in a powerful magnetic field, in this case no effect of a magnetic field could be detected in the course of the reaction.—*Phys. Rev.*, October.

REFERENCE.

Galvanic Cell.—COOPER.—The conclusion of his illustrated article on "The osmotic pressure theory of primary cells" (Digest, Oct. 20). He describes how single e. m. f.'s can be measured by means of the drop electrode and shows how the electrolytic solution pressures of different metals can then be calculated. The article is concluded with some brief remarks on the study by Bancroft and Taylor of the effect of varying the negative ion.—Lond. *Elec.*, Oct. 5.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Plotting the Current and E. M. F. Waves in the Rotor of an Induction Motor.—RUPP.—An article, illustrated by diagrams, in which he discusses several methods. For all those based on the principle of Joubert's contact device, a shaft is required which revolves synchronously with the period of the alternating wave to be plotted; to plot the current of e. m. f. wave in the rotor of an induction motor, a shaft is therefore required revolving synchronously with the period of this wave, which is proportional to the slip. To get such a speed the current in the rotor of the induction motor is led to the stator of a synchronous motor which is excited with direct current; or he connects the rotor circuits of the induction motor with the starting recistance and connects in parallel with the latter the stator of a synchronous motor; he reproduces some waves obtained in this way, but it is evident that they do not at all correspond to the normal conditions under which an induction motor works with a short-circuited rotor. He then suggested using a contact device, by which the instantaneous contact, required for plotting a point of the curve, is made at moments when the relative portions of the rotary field and the rotor are the same. It consists of two parts, one revolving synchronously with the rotary field in the stator of the motor, the other participating in the motion of the rotor. The first part is mounted on the axle of a synchronous motor connected to the primary network and consists of two brushes placed side by side and connected to two slip rings on the axle of the synchronous motor. The second part consists of a wooden box, fixed on the pulley of the induction motor; this box has a ring of vulcanized fibre on which these two brushes slide; a small piece of metal inserted in this ring makes the instantaneous contact between the two brushes, and therefore also between the two slip rings. The moment at which this contact is made always correspond to the same relative positions of field and rotor, and hence also to the same instantaneous value of the wave. To obtain different instantaneous values the different positions of field and rotor must be varied; this can be done in several ways; either the brushes may be so mounted on the axle of the synchronous motor that their position can be changed in the direction of revolution; or a synchronous motor may be used, the position of the stator of which can be changed around the axle of the motor; or the stator may be fixed, while the position of the rotary field is changed, which may be done by using an auxiliary induction motor as transformer, the stator being connected to the primary network, the rotor supplying the stator of the synchronous motor; the auxiliary induction motor is held at rest, and by changing the relative position of its rotor and stator, the shifting of the rotary field mentioned above is accomplished.—*Elek. Zeit.*, Oct. 4.

Determining the Frequency of the Wehnelt Interrupter.—RUHMER.—An article in which he describes a new method for determining the frequency of a Wehnelt interrupter, by means of a graphical method similar to Lichtenberg's figures. A metallic circular disk is covered with paper, which is printed with black shellac; lycopodium is sprayed upon it, and it is revolved at a high and uniform speed. At the same time a spring slides on the surface of the disk, slowly from the centre to the rim, in the direction of the radius, removing the lycopodium so that the black paper is seen. It is evident that the black line obtained in this way has a spiral form. By connecting the metallic disk with the negative, and the sliding spring with the positive pole of the circuit of the Wehnelt interrupter, the apparatus acts like a condenser. At each interruption of the current the positive sliding spring is discharged. The black spiral line is then interrupted by small heaps of lycopodium. Each heap corresponds to one interruption, so that by counting the whole number of heaps the frequency of the interrupter is found. This method is applicable when the self-induction of the circuit is not too small; in other cases the photographic methods, especially with the use of Braun's cathode tube, is preferable.—*Elek. Zeit.*, Oct. 4.

Platinum Thermometers.—TORY.—An account of experiments made to determine the probable order of accuracy in the determination of high temperatures attainable by the use of ordinary commercial specimens of platinum wire; also to determine the effect of large variations in the purity of the wire. Five wires were compared over the range 400 degs. to 1000 degs. C. The fundamental coefficients of the wires, which may be taken as an indication of the purity, varied by 40 per cent of the maximum value. Nevertheless, the extreme variations of the temperatures observed, when calculated by a certain formula, were less than 1 per cent on the interval at any point. Probably the platinum wires used were free from contamination with baser metals outside the platinum group; by contamination with baser or more volatile metals, it is possible to get much larger variations in the values of the temperature; but such pyrometers will not show constant results until the volatile constituents have been burnt out. Special attention was given to the effects of annealing which may produce changes in the zero, of the order of one degree after the first exposure to a temperature of 1000 degs. C.; with this exception, no changes of zero of any importance were observed, as the temperatures employed never exceeded 1000 degs. C.—*Phil. Mag.*, October.

Measuring the Resistance of a Galvanometer.—DAY.—An illustrated description of a new method of measuring the resistance of a galvanometer which can be used with apparatus which would not permit the use of the other usual methods, and which may be of use also as a laboratory experiment. It is based on the fact that "if the terminals of a galvanometer are brought to a certain potential difference, and the resulting current through the galvanometer gives a certain constant deflection, when the needle comes to rest, then, if we double this potential difference, in order to keep the same current through the galvanometer and the same deflection, it will be necessary to

double the resistance of the galvanometer circuit by adding a resistance equal to that of the galvanometer."—*Phys. Rev.*, October.

Hot Wire Instruments.—W. J. LLOYD.—A reply to the criticism of Stevens (Digest, Sept. 29). He denies that as a shunt ammeter the hot wire instrument is a distinct failure. He denies that if the instrument was calibrated on direct current and used on alternating current, then the difference in inductance in the shunt and instrument would introduce an error of 10 per cent; he remarks that the higher the frequency the more apparent the discrepancy will appear, but will never amount to 1 per cent on any commercial frequency. As to heating errors, and the tendency to burn out on overload, these difficulties can be overcome by good design.—*Elec. Rev.*, Oct. 10.

REFERENCES.

Alternating-Current Instruments.—ADDENBROOKE.—A reprint of his Internat. Elec. Cong. paper on his alternating-current electrostatic instruments, noticed in the Digest Oct. 27.—*El'ty*, Oct. 24.

Measuring the Resistance of Cables.—HEAP.—A reprint of the illustrated English article, abstracted in the Digest Oct. 27.—*El'ty.*, Oct. 24.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Ground Wires for Fire-Alarm Telegraphs.—MEAD.—A brief paper, read before the Internat. Ass'n of Fire Chiefs at Charleston, on the question, "Should the use of ground wires in connection with fire-alarm telegraphs be discontinued?" He agrees that ground wires are desirable under certain conditions and for certain purposes. While he recommends having a good ground wire connection at all box points, he believes it is not desirable to connect this wire permanently, but instead to have it so arranged that it may be conveniently connected to the circuits when it is necessary to do so for any purpose.—*West. Elec.*, Oct. 13; *El'ty*, Oct. 17.

REFERENCES.

Telephone.—MONTILLOT.—An illustrated description of a new type of Breguet telephone transmitter.—*L'Elec.*, Sept. 15.

Colorado.—DICKERSON.—An illustrated article on new Colorado telephone exchanges, especially on the exchanges in Colorado Springs and Pueblo.—*West. Elec.*, Oct. 13.

Automatic Fire-Alarm Systems.—BURGHER.—His paper in full, read before the Internat. Ass'n of Munic. Elec. and abstracted in the ELEC. WORLD AND ENG., Oct. 6, p. 534.—*El'ty*, Oct. 17.

Cable Work—BARWELL.—A reprint of the illustrated English article giving "an explanation of a common phenomenon noticed in cable work" (Digest, Oct. 13).—*El'ty*, Oct. 10.

Typeprinting Telegraphy.—PIERART.—A brief communication referring to the paper of Conradt on the improvement of the efficiency of the Hughes apparatus, by a modification of the arrangement of the keys (Digest, Oct. 13). He criticises some special points.—*Elek. Zeit.*, Oct. 4.

MISCELLANEOUS.

Electricity for Stimulating Plant Growth.—IYURIN.—A note on a paper read before the St. Petersburg Elec. Soc'y, and giving some information on experiments made by Sypeshneff and Krankoff. Electrified seeds germinate more rapidly, give better fruits and from 2½ to 6 times greater crops than seeds not before electrified. When a copper and zinc plate were buried in the soil vertically and connected by a wire, potatoes and roots grown in the electrified space gave crops three times heavier than those which were grown close by. Further, on a plot about 10 yards apart, wooden posts were planted, provided at their tops with metallic needle points connected together by wires, so as to cultivate the plants under a sort of network of wire; some striking results were thus obtained, one of which was that the growth and ripening of barley was accelerated 12 days. Krankoff has undertaken a series of laboratory experiments upon boxes of soil submitted to electric currents; the amount of vegetable matter in the soil was increased.—*West. Elec.*, Oct. 20.

Electric Heating Apparatus.—A description of some new heating apparatus, made by a German company. The heat is generated in resistances formed of thin films of precious metals, such as gold, platinum, etc., deposited on an insulating base of mica, enamel, or other suitable material; it is said that resistances up to 25,000 ohms can easily be obtained. The stoves for these strips are circular; the strips are mounted in two rows on a frame fitting into a circular case; the outer row radiates heat directly, and a continual current of air passes up and is heated between the two rows. The smallest pattern of stove contains 12 strips, weighs 5 lbs. and takes 6 to 8 amp. at 110 volts; it is used for heating rooms of from 700 to 900 cu. ft.—Lond. *Elec.*, Oct. 12.

Electrical Prospect in the Philippines.—G. D. RICE.—An article in which it is said that there is no doubt that American manufacturers of electric fans, motors and other such devices will profit largely by the acquisition of the Philippines, just as soon as more permanent peace is assured. There are a number of capitalists ready in each city and town of importance to establish power stations for the electric light systems, electric railways, and for power purposes. The natives of the islands regard American fans and motors as superior to those imported from Germany, Great Britain and Spain. There is a very large demand for fans for cooling the interiors of workshops, sugar mills and residences of the wealthier class; also for ventilating the numerous mines. The demand for motors may exceed the expectations, for the reason that there is a vast amount of woodworking machinery, printing machinery, mining machinery and machinery in the metal working shops that cannot very well be operated by steam power, owing to prevailing conditions, but which can be run by small motors. Good packing of the imported goods is essential.—*West. Elec.*, Oct. 20.

Magnetic Separators.—SMITS.—A brief article on a Wetherill separating plant in the Siegen district in Germany. Two diagrams show two types of separators, one with two magnetic poles and two running belts, the other with three poles, one positive and two negative, and one running belt.—*Eng. and Min. Jour.*, Oct. 20.

Paris Exposition.—The ninth part of the well-illustrated serial dealing with machine exhibits of Swiss firms. Sulzer engines are described more especially, also a 5500-volt, 1300-kw amp. three-phase alternator of the Oerlikon Company running at 94 r. p. m.; it furnishes, however, only about 1000 kilovolt amp. single-phase at 2200 volts for the light and power service of the exhibition, the winding of the armature being disposed in parallel to permit of this arrangement.—Lond. *Elec.*, Oct. 12.

REFERENCES.

Electric Furnaces.—KELLER.—A translation in abstract of his Internat. Elec. Congress paper, which was abstracted in the ELEC. WORLD AND ENG., Sept. 15, p. 412.—*West. Elec.*, Oct. 20.

Engineers in the War.—An illustrated description of some of the work done by the Electrical Engineers R. E. Volunteer Corps in the Transvaal war.—Lond. *Elec. Rev.*, Oct. 22.

Electric Ignition for Gas Engines.—ROBERTS.—An article, illustrated by diagrams, in which several methods of electric ignition are described for use on gasoline automobiles.—*The Automobile*, October.

New Books.

BOOKS RECEIVED.

GALVANIZING AND TINNING. A Practical Treatise on Coating with Tin and Zinc, with a Special Chapter on Tinning Gray Iron Castings. By W. T. Flanders. David Williams Company. 93 pages, 40 illustrations. Price, $2.00.

FREE-HAND PERSPECTIVE. For Use in Manual-Training Schools and Colleges. By Victor T. Wilson, Cornell University: 268 pages. Cloth, $2.50. John Wiley & Sons, New York: Chapman & Hall, London.

The Autophone in New York City.

The American District Telegraph Company, of New York, is introducing on its lines an instrument which has every promise of vastly improving its service. As is well known, the present district messenger system includes a messenger call box at one end of a circuit and a register at the district office, on which the number of the calling box is recorded. When a call is received, a messenger is dispatched to the person calling, to ascertain his wants and execute his orders. Sometimes messengers tarry on the way and are slow in answering the call, but this annoying feature of the service is obviated by the new instrument—the autophone.

This apparatus consists essentially of a combination of a telephone transmitter and receiver and a messenger call box. By lifting the receiver off its hook a telephone call is sent in to the district office, the

signal being registered in a manner exactly similar to that sent in by the ordinary call box, but with an extra mark on the receiving tape to indicate that the call is for a telephone connection. The operator at the office then takes his receiver and over the telephone ascertains the wishes of the person calling. The conversation is carried on exactly in the same manner as over an ordinary telephone, and when it is ended the subscriber hangs up his receiver.

At the right of the instrument will be noticed a projecting lever. By pulling this lever down, a messenger call is sent in precisely the

THE AUTOPHONE.

same manner as in using the old style call box, and a messenger is despatched from the officer to answer the call. Thus in the new instrument the old feature is maintained as a part of the new service, and either the telephone or messenger call is available.

The advantages of the added telephone service are obvious. It is evidently a time-saving device, as it enables the subscriber to give his

HEAD TELEPHONE.

orders direct to the office without waiting for the uncertain messenger, the directions being given to the messenger at the office. A peculiar feature of this new system is that it is virtually a one-way telephone. The subscriber can reach the district office, but there is no way for the latter to call the former, and to this extent the subscriber is protected against needless annoyance from telephone service. The American District Telegraph Company has several of the instruments in use, and we learn that they are giving much satisfaction.

Telephone Headgear.

The illustration in the preceding column shows, without the need of many words, a new telephone headgear made by the Swedish-American Telephone Company, 69 West Jackson Boulevard, Chicago, Ill. The watch-case receiver is of the company's standard make, and the device both as to material and construction is of the best character. The headgear has the usual means for adjustment to the head.

In this connection it may be stated that this company is also manufacturing a complete line of high-grade series and bridging telephone instruments, all of which are equipped with its improved Swedish transmitters and receivers. It also manufactures centralized battery instruments adapted for any type of switchboard.

A New System for Measured Telephone Service.

The tendency of telephony is said to be toward a measured or metered telephone service. This fact is shown by the action of some of the largest companies in the telephone business. The importance of a metered service has become so fully recognized in the electric light industry as to admit of no further argument in its behalf. It is now thoroughly understood that a measured service in electric lighting is the only rational method of charging, provided, of course, proper provisions are made to secure a minimum rate, which will pay the interest on the investment. It is hardly necessary here to go into any extended argument on the question of the advantages of a measured telephone service, as against the usual flat rate method of charging. It is sufficient to say that the largest exchanges are

FIG. 1.—SUBSCRIBER'S DESK INSTRUMENT AND CALL REGISTER.

earnestly looking into the matter of measured service, and are daily increasing the extent of such service. Although the measured rate may come hard on subscribers making a large number of calls per day, there are a great number of offices which will install telephones on a low measured rate in preference to paying a large flat rate, though, as a matter of fact, the income of the telephone company will probably be increased by the introduction of measured service. It is safe to say that were it not for the absence of more satisfactory methods of measuring telephone service, a measured service would have become common long ago, and now that methods are being worked out, and the plan is being tried, its popularity with the public and with the telephone companies themselves points to its very general adoption. The problem of devising a successful meter or call recorder for telephone service is one that has at present been solved by few, and makes great demands upon the ingenuity and skill of the best telephone engineers. Many of the

largest and strongest companies have adopted the plan of measured service by which the recording is done by the operator in the ordinary clerical way, with pen or pencil, a method which would hardly seem to be on a par with modern methods of recording in other lines of work, on account of the delay involved. The meters so far devised may be divided, roughly, into three classes. In the first class, the meter is located at the subscriber's station, and must be controlled or supervised from the central office, either by the ringing of a bell, or by the operation of a vibrator in proximity to the talking circuits of the telephone. The registration in this case is accomplished by apparatus for making a sound by buzzer or otherwise at the subscriber's meter, which announces to the operator the fact that the calling party has registered. In the second class, the meter is located at the central office, and operated manually by the switchboard operator, or automatically by relays or auxiliary magnets in such a way as to utilize the current flow caused by the act of the answering or called party in removing his receiver. In the third class, duplicate registers are provided at the subscriber's station, and central station, actuated simultaneously by either the subscriber or the operator. The new system, which it is the purpose of this article to describe, operates in a manner different from any of the three systems enumerated. Briefly, it consists of a simple counter or recorder at the subscriber's station, and a portable record-taker or call counter at the central station, this portable record-taker being connected at the end of each month with the subscriber's station in turn to take the record of the meter at each such station.

Before going into details, it will be well to describe the working of the system without regard to the electrical method of accomplishing the result. At each subscriber's instrument is placed a small register

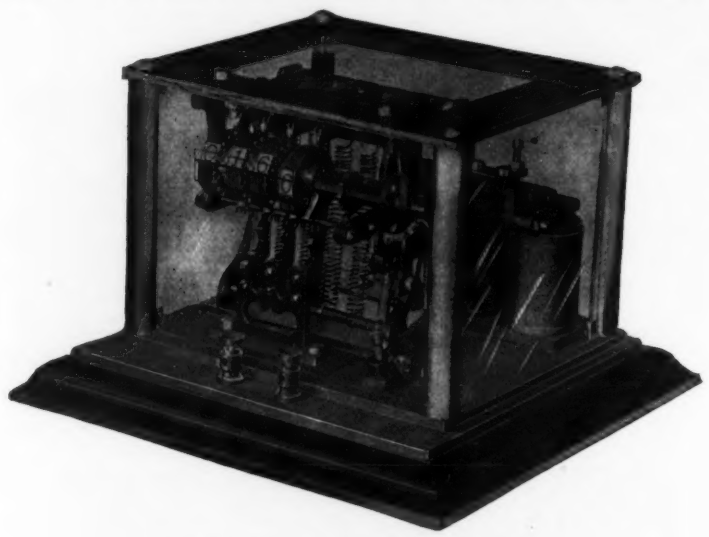


FIG. 2.—CENTRAL OFFICE RECORD TAKER.

box, shown in Fig. 1, which has the push button on top, and register figures exposed at one side of the box, indicating the total number of calls made since the subscriber's telephone was put in service. When a subscriber wishes to call central, he does so in the usual manner, but before the central office operator will give him the desired connection he must press the button on his recording instrument, which accomplishes three results, one being to record his call on the register or counter, one to close a vibrator circuit which makes a buzzer signify to the operator that the subscriber has registered, and the third to wind the spring which stores the call. The connection is then made by the operator, and talking proceeds as usual. The subscriber's register now evidently shows the number of calls he has made since the telephone was put in. At the end of each month, the register clerk at the central office takes a portable registering device, Fig. 2, and connects it with each subscriber in turn, making the request of the subscriber to press the button of his register, and also to announce to the central office clerk the number of calls indicated on his register. When the proper connection is established between the subscriber's register and the automatic call counter at the central office, the call counter will, in a few seconds, indicate a duplicate of the number recorded on the subscriber's register. The subscriber and clerk then compare numbers, and the clerk is free to go on with the next subscriber. In this way, in a short time a few clerks at the central office can take the register readings of the entire exchange. No extra subscriber's wires are required, the only additional instrument at the subscriber's station being the small and simple register. One or two portable record-takers will do the work for an entire large exchange. The plan is applicable to both local and common battery systems and party lines, this being one of the advantages of this system over some others. The record-taker will act so rapidly that even where the number of calls registered is as high as one thousand, the record will be transmitted in a few seconds. The electrical method of accomplishing this is shown in Fig. 3, which is a diagram of circuits for the system. *A* represents the subscriber's register and telephone, and *B* the portable counter with its battery at the central station. This portable counter may be plugged in at any of the multiple jacks, but in practice it would be more desirable to plug in outside of the multiple board entirely, say, at the distributing racks, so as to be free from central office interference, during the time of taking the register reading. The switchboard should be preferably cut off entirely, as indicated by *K*, Fig. 3. The subscriber at *A*, desiring to make a call, removes his receiver (the diagram indicating the instrument used on the usual Bell common battery system), and gives his order to the operator, who completes the connection and calls the party wanted. As soon as the called party responds, the operator requests the calling party to press the register button *a*, which must be done before conversation begins. The operation of pressing the button sounds the buzzer *b*, by closing the circuit from *L*1 to *c* through *b* and *a* and by *d* being brought in contact with *e* and thence completing the circuit to *L*2. This same motion of the button *a* moves the counter *S*2 one number forward and rotates the cam wheel *g*, winding up a spiral spring, similar to a watch spring, and thus, as it were, storing the call. When it is desired to take the reading of the subscriber's register, the clerk at central office plugs in his reading instrument at *K*, as before mentioned, and rings the party at *A*, requesting him to press the button at *a*, which closes the controlling circuit at *a*, through coil *m*, through *d*, *e* and to *L* 2, thence to *k* and through limb *O*2 of battery and switch *h* to ground, completing the controlling circuit, and energizing magnet *m*, which draws down its armature, and closes together the contacts at *e* and *r*, also maintaining the connection made at *e* and *d* by the act of pressing the button. The energizing of magnet *m* also releases pawls which check the spring connected with *g* and the latter rotates backward, giving motion to the arm *c*, which intermittently closes circuit through *r*. The

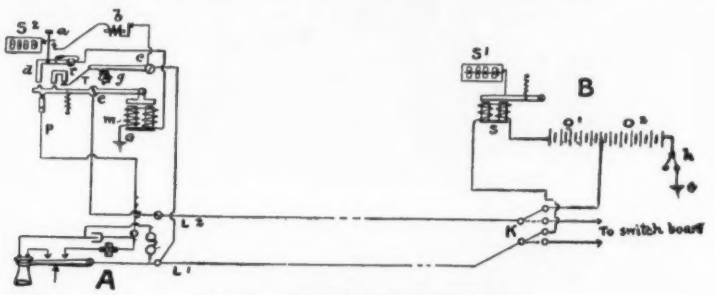
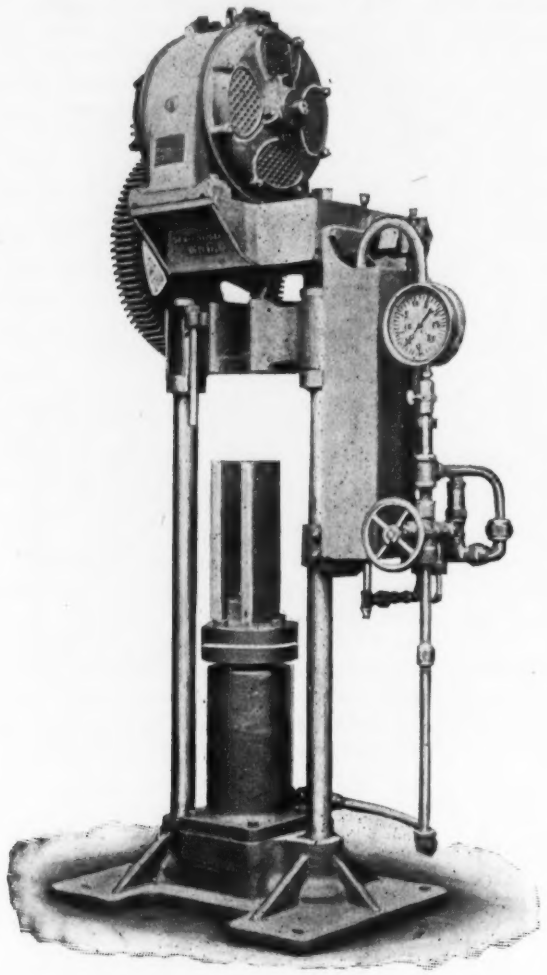


FIG. 3.—DIAGRAM OF CIRCUITS.

number of strokes of the arm *c* represents the number of calls stored on the spring. Thus the closing of the circuit at *c* and *r* gives an impulse over the line, which actuates the call-counter magnet *s* at *B*, operating the counter *S*1, thus transferring the registered calls to the reading instrument at the central office. After each reading the counter *S*1 is restored to zero by turning a button on the counter. The counter *S*2 at the sub-station does not reset, but continues to count to 9999, and then reverts to zero, thus making it possible for the subscriber to see how many calls he has used from time to time, and giving the company a positive record of actual calls made, should any trouble arise in the transmission of the reading to the central office counter. The number on the receiving instrument *S*1, after reading, added to the previous total, should equal the number indicated at the sub-station. The diagram shows the application of the counter to the regular Bell common battery subscriber's station. The clerk's telephone outfit at the central office, used in connection with the counter, is not indicated in the diagram. The system is manifestly one possessing very many desirable points. It is the invention of H. D. Stroud, a telephone expert of Chicago, assisted by L. A. Schmidt, a linotype expert and machinist of ability, master mechanic of the Chicago *Times-Herald*. American patents have been allowed and foreign patents have been filed in all European countries where telephones are used to any great extent. The instruments will be manufactured by a new company, which has been formed under the name of The National Measured Service Company, 1039 Marquette Building, Chicago.

Thirty-Ton Armature Press.

The illustration which is presented on this page gives a very good idea of the appearance of a 30-ton hydraulic press which is being manufactured by the Watson-Stillman Company, of New York. The press is especially intended for pressing the laminations of armatures together after they have been placed upon the shaft, and special modifications have been made in the press to adapt it for this service. As will be seen from the illustration, the lower block is mortised and the upper block contains a jaw to facilitate the introduction of the shaft of the armature. The upper block can be swung to the rear in order to enable the operator to place the disks over the shaft after the latter is in position for pressing. The press piston has a motion of 9 ins., which allows it to be used on many sizes of work. The hydraulic pump shown at the right is operated by a Westinghouse motor and reducing gear on the top of the press frame. The piping from the pump to the press cylinder is of the best drawn steel tubing. This press has a distance between the upright rods of 15½ ins., and the jaws are large enough to permit of pressing work on a 3-in. shaft.



30-TON HYDRAULIC ARMATURE PRESS.

The Schmidt Patented Adjustable Telephone Arm Without Connection Cord.

The Lambert Schmidt Telephone Manufacturing Company is introducing an adjustable telephone arm without connection cord at the side and we show with this article two cuts of this arm, Fig. 1, with all the parts assembled, and Fig. 2, showing the parts separate. On this arm they use their special coal-grain long-distance transmitter, which sets in a socket on the end of the arm. From this socket extends two strong steel rods to a hard rubber disk at the base, this disk being mounted between two side flanges. On each side of this disk is a U-shaped phosphor bronze spring, which makes a strong rubbing contact with the side flange. At the back of this hard rubber disk is a heavy pin regulating the swing of the arm. These two side flanges are mounted on a hard rubber block, which is itself mounted on the front of the enameled iron back of the arm. Inside this back is the long-distance induction coil.

The circuit is completed from the transmitter through the heavy steel rods to the hard rubber disks, then through the phosphor bronze springs to the side flanges, and from there to the coil box in the back of the arm.

The transmitter is screwed into the socket and fastened by a nut in the back of the socket. The arm is worked out in all its details, and has seen severe service in practical operation with highly satisfactory results. It is without question one of the most efficient adjustable telephone arms on the market, and is applicable to any telephone instrument.

FIG. 1.—ARM ASSEMBLED.

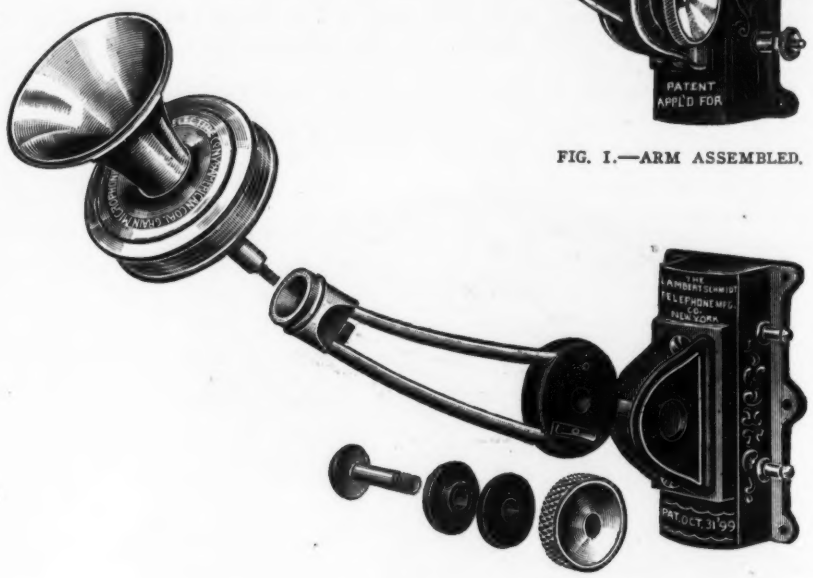


FIG. 2.—SEPARATE PARTS OF ARM.

The Lambert Schmidt Telephone Manufacturing Company advise us that they are receiving numerous orders from public exchanges for this arm, and that they will be glad to open up correspondence with any one desiring information on this apparatus.

Improvements in Magneto and Central Energy Telephone Apparatus.

The accompanying Figs. 1 and 2 show two types of instruments recently introduced by the American Electric Telephone Company, of Chicago. The instruments are designed for the most exacting service. Fig. 1 shows an equipment in which the usually somewhat cumbersome magneto call telephone equipment is improved in appearance by the manner in which the operative elements are mounted. Thus the magneto generator, magneto signal bell, induction coil, switch hook and two dry batteries are all enclosed in the one box. The front of this box may be swung outward to the right, thus permitting of ready access to all of the parts belonging to the equipment. The transmitter used in this equipment is a new American long-distance type, and the receiver is of the well-known Bell style construction.

Fig. 2 shows an equipment which may be used in connection both with full central energy or centralized call switchboards, and the company is prepared to furnish this equipment ready for operation in con-

nection with any system of switchboards operating on the full central energy or centralized call plan.

Sufficient room will be found in the instrument for placing four dry cells, or less, and a condenser if needed. This form of equipment is used on a centralized call system, and equipped with two or three

FIGS. 1 AND 2.—TWO TYPES OF WALL TELEPHONES.

dry cells, service may be had over the most difficult circuits. The transmitter differs from the company's regular product, in that it is arranged for long-distance central energy work.

The Fowler Central Energy System.

The Fowler Telephone & Engineering Company, of 325 Broadway, New York City, is putting out a central energy system which presents many novel and interesting features. One of its chief elements is its extreme simplicity, it being free from the ordinary coils and relays present in the cord circuits and other parts of central energy systems. The line from a subscriber's station terminates in a drop, which in this system is a small relay, the local of which controls a miniature incandescent lamp placed behind a ⅜-in. opal glass bull's-eye. This is the line signal, and is placed directly over the answering jack of the circuit.

No other coil or relay of any sort is used in any part of the system. This signal is self-restoring without the breaking of the circuit and without the use of a cut-off relay; one of which methods has heretofore always been used. The cord circuit is equipped with the double system of miniature lamp signals, one to each plug of the cord circuit, thus providing a supervisory signal as well as a clearing out signal. The action of each lamp is controlled by its connected instrument independent of the instrument on the other end of the circuit.

The cord circuit is free from all relays, or coils, and, in fact, consists only of the two conductors joining the tips and sleeves of the respective plugs; and the cord circuit is not connected to the common battery. The battery for working the signal is permitted to flow over the circuit when the receiver is taken from the hook; and this battery is not cut off and a new current thrown on the line when the plug is inserted in the jack.

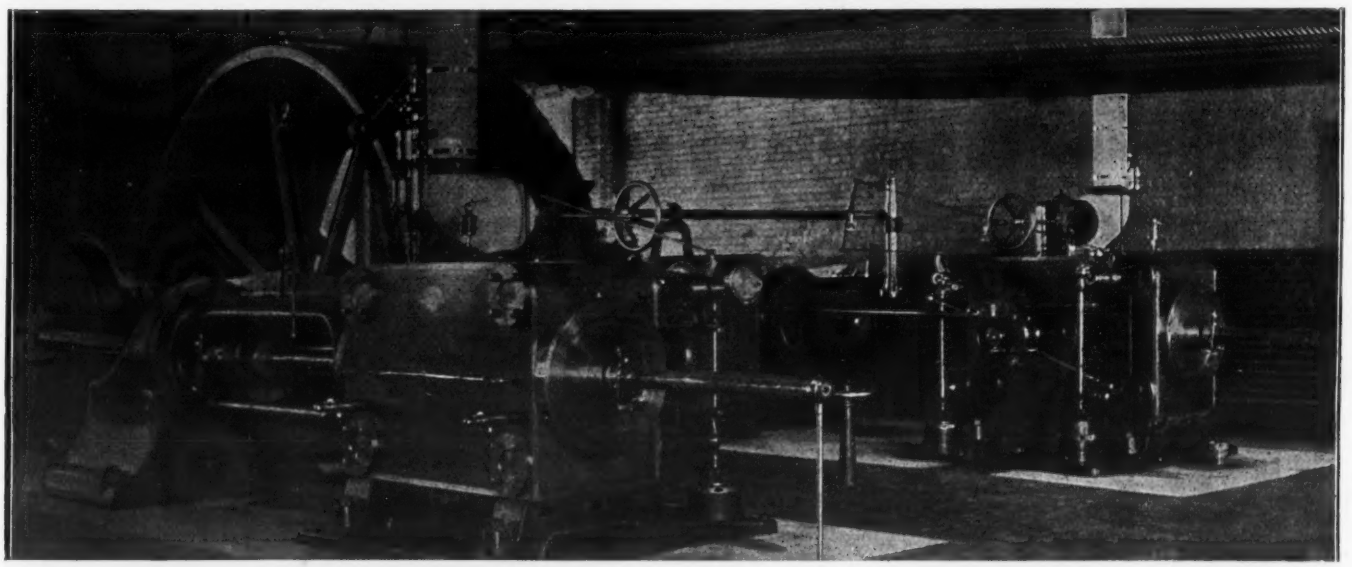
Another valuable feature of this system is that there is no break anywhere in the line from the subscriber's station to the last jack on the line. The line is, of course, opened and closed at the switch hook in the instrument, but outside of this contact there is no contact anywhere in the talking circuit except those made between the jack springs and the plug. But over these contacts even, there is never any flow of current from the common battery.

The switchboard being put out by this company is of the full multiple type and made in any size required. The talking circuit is of notable efficiency and range of action, and with it, it is practicable to place instruments as far from the common battery as 30 ins.

The system as a whole is said to be unusually efficient, simple, and is very economical to operate. It is as simple as any magneto switchboard, and for that reason can be installed and operated by any one familiar with the usual circuits of the old style system. A point in this system that will appeal forcibly to the buyer, however, is its low first cost, a matter susceptible of easy determination.

A Vilter-Corliss Engine at Itasca, Wis.

The Vilter Manufacturing Company, 901-919 Clinton Street, Milwaukee, Wis., illustrate in the cut herewith a very fine Corliss engine, which was erected by them for the Itasca elevator, of the Chicago, Minneapolis, St. Paul & Omaha Railway at Itasca, Wis. The cut shows the interior of the engine room. The engine installed is of the heavy-duty type. The cylinders are 24-in. bore and 48-in. stroke. The wheel is 18 ft. diameter and is provided with 26 grooves for 2-in. rope. The superintendent of construction reports his great satisfaction as to the installation work and the running of the engine. This type of engine has been installed by the Vilter Manufacturing Company for many similar plants. The concern is running its works day and night to cope with the many orders it has been receiving for Corliss engines, refrigerating and ice-making machinery.



STEAM PLANT IN THE ITASCA, WIS., ELEVATOR.

Kneeland Reflector Shades.

Three styles of incandescent lamp shades manufactured by the Kneeland Reflector Company, 222 Friend Street, Boston, Mass., are shown in the accompanying illustrations. The desk shades are made in five sizes—7, 8, 9, 12 and 15 ins.—the 7, 8 and 9-in. sizes being finished in silver or green bronze and green enamel. The 12 and

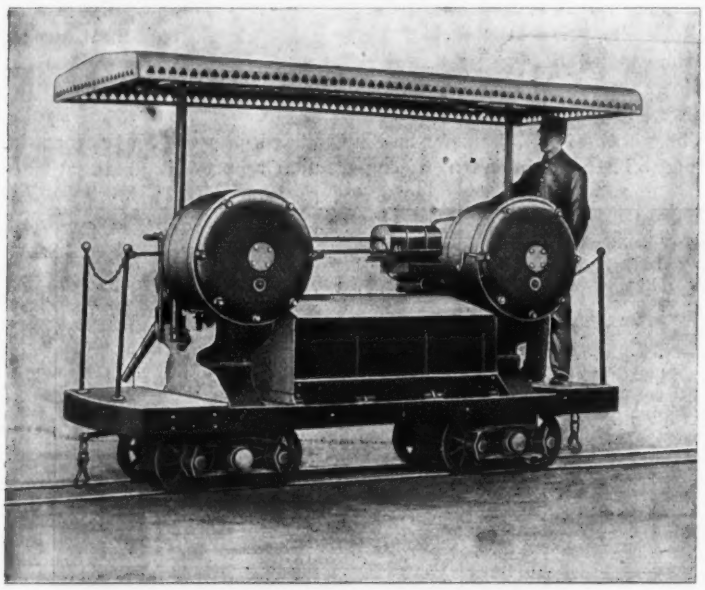
REFLECTOR SHADES.

15-in. sizes are in silver bronze only. The 7 and 8-in. disk shades have an eye protector on one side, extending about one-third the distance around, while the hood shades have the eye protector all the way around, leaving only a small opening at the bottom for the light to pass through. The company also manufactures half-shades of aluminum, silvered glass and tin, shade holders, etc.

Hunt Electric Locomotive.

In large shops, foundries and manufacturing plants a railway for the purpose of moving heavy material from one part of the establishment to another is an essential requirement. Electricity is the ideal propelling power for such railways, and is now widely used in such work. Usually the current is distributed over the line by means of overhead construction, but in one system devised by the C. W. Hunt Company no such construction is necessary, since the locomotive carries with it the source of its power, viz: a storage battery.

The accompanying illustration shows one of the Hunt storage battery locomotives. The battery is divided into sections, which are connected through the controller with the motor armatures and fields in various combinations or series-parallel effect, thus obtaining the different variations of draw-bar pull and speed required. Unusually



STORAGE BATTERY LOCOMOTIVE.

large and heavy battery plates are used, which are not overworked even in starting the load, the demand upon them being only 1 or 2 watts per pound of lead.

Two independent series-wound motors are used, which at low speeds give a great starting effort with a minimum consumption of current. The locomotive is equipped with two four-wheel trucks, each wheel being a driver, and is able to ascend the heaviest grades found on this class of railways. These locomotives are not designed for long hauls or heavy grades, but for the class of work above referred to they possess many advantages. The batteries, motors and gearing are all located above the floor, with every part in plain sight for convenient inspection or adjustment.

A New High-Speed Engine.

The engine illustrated herewith is especially adapted for direct connection to dynamos, fans, centrifugal pumps, and in such connection, it is said by the manufacturer, the Vezin Machine Company, 95

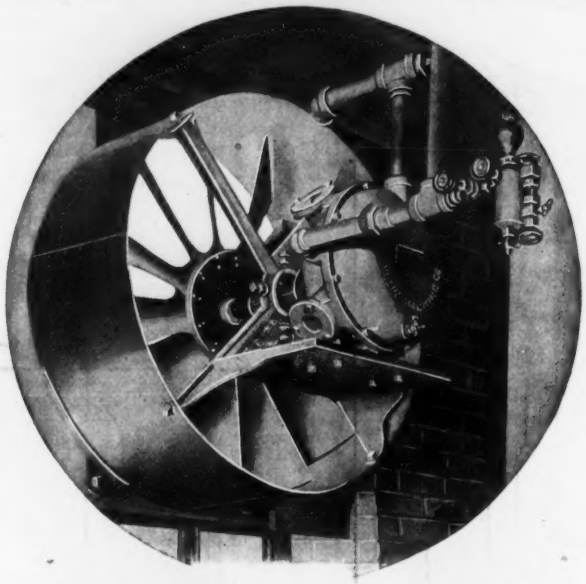


FIG. 1.—ENGINE DIRECT CONNECTED TO VENTILATING FAN.

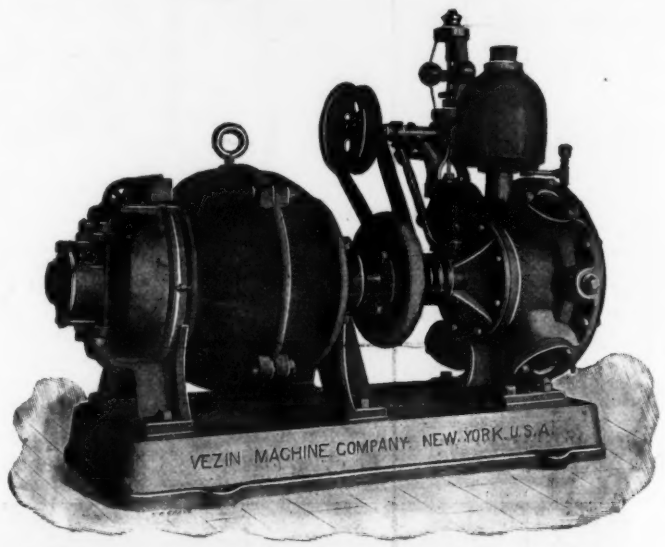


FIG. 2.—ENGINE DIRECT CONNECTED TO 40-LIGHT DYNAMO.

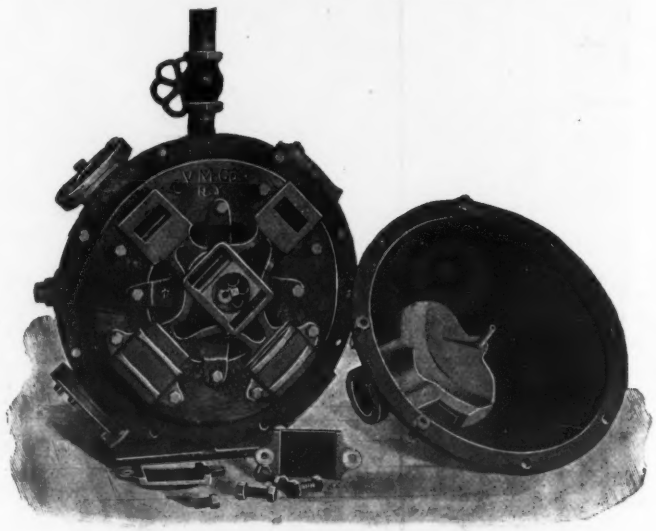


FIG. 3.—VALVE MECHANISM.

Liberty Street, New York, to have proven itself exceptionally efficient. A general view of the engine is shown in Fig. 4; in Fig. 2 the engine, direct connected to a 40-light dynamo, is shown; Fig. 1 repre-

sents it direct connected to a 36-in. ventilating fan; Fig. 3 shows it with the cover removed exposing the valve mechanism, and in Fig. 5 the form of the reciprocating parts is illustrated.

The engine is a four-cylinder, single-acting, Scotch yoke type, perfectly balanced and so lubricated that it may run at speeds heretofore impracticable in a reciprocating engine. The cylinders are set at right angles and, owing to their arrangement, the strain on the crank pin is kept constant, two of the cylinders being, one under boiler pressure, and one working expansively, while the other two are in the stages of exhaust and compression. The pistons are arranged in pairs, each pair being rigidly connected so as to form a rectangular frame in which the crank pin brasses travel. The valves are of the gridiron type, all being actuated by one cam.

Outside of the arrangement of parts whereby the maximum amount of strength is obtained with the minimum quantity of material, the most interesting feature of this engine is in the lubrication. It is lubricated throughout by cylinder oil admitted with the steam supply; no greater quantity of oil being required than is commonly supplied to any engine of equal power from the usual sight feed lubricator. This is occasioned by the engine using for lubrication of the crank pin and other parts, the waste oil which passes out with the exhaust steam in the ordinary engine. In Fig. 4 is shown the eliminator, which separates the oil and water from the exhaust steam. Steam is admitted into the cylinders in the usual manner and is exhausted into the casing; it there mingles with the moving parts upon which it deposits a portion of the oil and water which is discharged from the cylinders. In leaving the casing the steam must first pass through a T-shaped chamber, shown on the inside of the cover, which is formed in the shape of a separator, its purpose being to separate the oil and water from the exhaust steam. The oil and water pass out through the small stem, or tube, and into the end of the crank shaft. In the crank shaft a series of canals are cut, through which the oil and water travel to the crank pin, the centrifugal force throwing it outward to the bearing surface. Pockets are also provided in the main bearings for the purpose of catching from the exhaust steam a portion of the oil and water which lubricates these bearings. Fig. 5 shows the hollow pistons which, being exposed to the exhaust steam, are internally jacketed.

The engine consists of but 14 different sections, exclusive of bolts and nuts, and, being interchangeable and without adjustment, it is possible for the most inexperienced man to renew or replace any parts. At the same time it is impossible to make improper adjustments. The engine has a fixed cut-off, thereby, it is claimed, eliminating many of the complications necessary in automatic engines. The ordinary throttling governor is found to be a satisfactory regulator for electric light work. Where the engine is used in connection with fans, or centrifugal pumps, a governor is not required. The engine is built in sizes from 3 to 30 horse-power, the smallest size running at a speed of 1500 r. p. m.

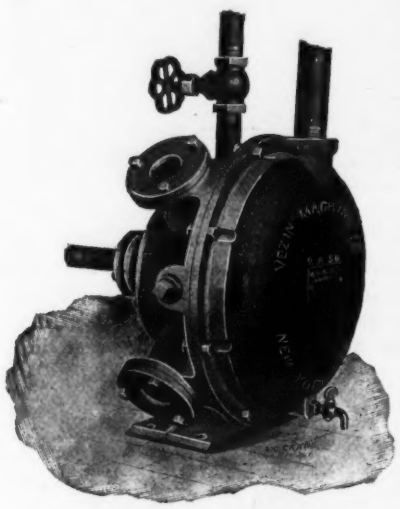


FIG. 4.—GENERAL VIEW OF ENGINE.

FIG. 5.—RECIPROCATING PARTS OF ENGINE.

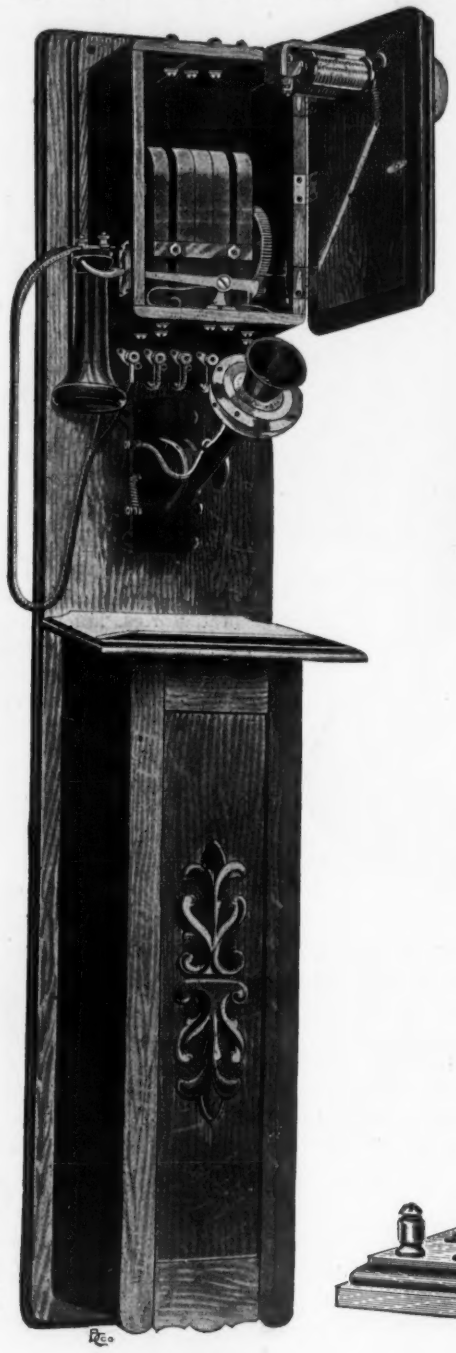


FIG. 1.—TOLL LINE TELEPHONE.

Improvements in Toll Line Telephone Apparatus.

As the proper working of telephone country toll lines depends so much on having strong magneto generators in order that the ringing may be good over long and leaky lines with many instruments bridged across, the Farr Telephone & Construction Supply Company, of Chicago, which makes a specialty of telephones suited to country use, has been putting some powerful generators on the market during the past year. The switchboard generators are made with five-bar magnets, heavily magnetized, and some are even made with six-bar magnets. Some of the latter generators, which have laminated armatures, will light a 16-cp incandescent lamp to about 4 candle-power. The bipolar receiver made by this company is made from the

FIG. 2.—SOLID BACK TRANSMITTER.

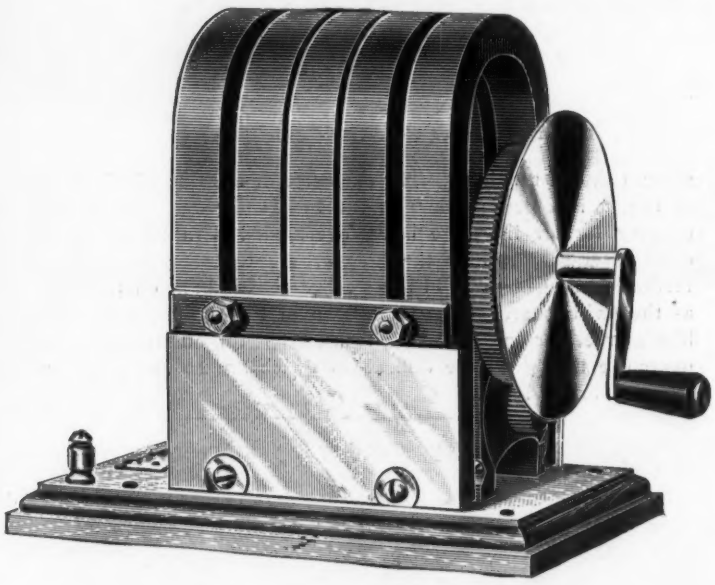


FIG. 3.—MAGNETO-GENERATOR.

best Swedish steel, and with strong magnets. The coils are wound to 120 ohms. As seen by Fig. 4, they are very compact, and the weight is only 13 ounces. They are assembled in a neat pony shell, provided with lock-nut binding posts. The Farr solid back transmitter, shown in Fig. 3, is provided with an aluminum diaphragm, made with a view of offering little resistance, and responding readily to vibration and giving good results with a small battery power. They are not easily put out of adjustment, and will stand a heavy battery, if circumstances should require it. The exchange or toll line telephone, shown in Fig. 1, is a new product of the Farr Company. As most of the country farmer lines are being overloaded with telephones, it becomes necessary to have the very strongest generators to give satisfaction. The generator in these telephones is built on the same line as the switchboard generator, shown in Fig. 1. Equipped with the bipolar receiver and the above transmitter, this instrument is said to overcome nearly all the difficulties which are so annoying on hard worked rural service.

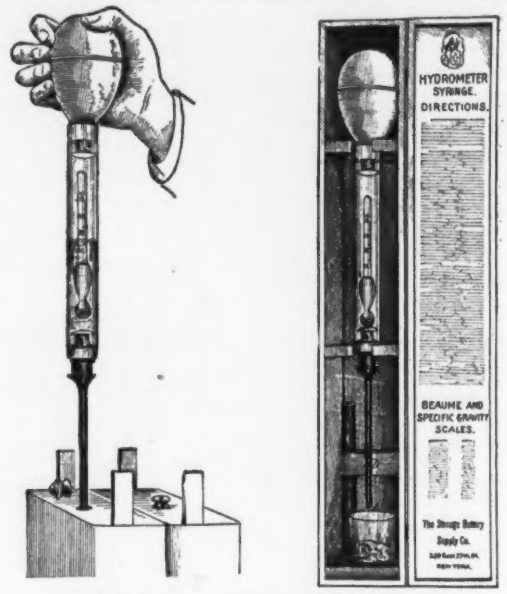
FIG. 4.—BIPOLAR RECEIVER.

Hydrometer Syringe.

The hydrometer syringe illustrated herewith is an instrument designed to do away with the present tedious and unclean methods of testing the electrolyte in storage battery cells. It also provides a convenient, cleanly method of adding or withdrawing fluid from the cells.

To test the specific gravity of the electrolyte with this instrument, all that is necessary is to compress the bulb slightly and to introduce the nozzle through the hole in the cover of the jar. Release the bulb, and the fluid rises and floats the hydrometer. The reading is made, the acid returned to the cell, and the same process is repeated for each cell to be tested. An additional nozzle is furnished for filling the cells with electrolyte to their proper level. The syringe is filled from the supply vessel, the nozzle is rested on top of the plates and by compressing and releasing the bulb the excess is withdrawn and the proper amount left above the plates.

The hydrometer syringe also answers admirably as a syringe for transferring the electrolyte from one cell to another. Its uses are not confined to storage batteries, as it is equally adapted to primary cells and to all other liquids for which special hydrometers are provided. The hydrometer furnished has both the specific gravity and Baumé scale for storage battery use. This instrument has been patented by the Storage Battery Supply Company, 239 East Twenty-seventh Street, New York City.



FIGS. 1 AND 2.—HYDROMETER SYRINGE.

The Clark Automatic Telephone Switchboard.

The Clark Automatic Telephone Switchboard Company, of Providence, R. I., is placing upon the market an instrument designed for use in factories, hotels, warehouses, public buildings, small towns, etc., by which, it would appear, from three to one hundred and fifty telephones may be operated automatically. The Clark system does away with ordinary central station expense such as office rent, fuel, light, operators, etc., thereby eliminating the principle items of maintenance; and as the connections are all made mechanically and may be made at any time, a greater speed is claimed than under the old system.

FIG. 1.—DESK SET.

The accompanying cuts will illustrate the apparatus. It consists of a calling dial or transmitter, Fig. 1, and an automatic switch or receiver, Fig. 3. The transmitter consists of an indicator with dial upon which is shown as many numbers as there are telephones, and a circuit making and breaking machanism, the normal operation of which is continuously forward. The mechanical relations between

the indicator and the circuit making and breaking mechanism are such as to allow the indicator to be set in advance of that mechanism at a position corresponding to that which is desired. At this point a power connection is established between the indicator and the circuit making and breaking mechanism which moves the mechanism after each setting of the indicator, to a position corresponding to that occupied by the same.

The receiver or switchboard apparatus used with this transmitter consists of a governing electromagnet which is supported by a frame mounted on a hard rubber base, as shown in Fig. 3, and whose armature engages a switch wheel which is pivoted on the hard rubber base and around which is a circular series of contact points corresponding in number to the number of transmitters and from which "service wires" run to the talking instrument. The periphery of the switch wheel is toothed and has a spring running from the wheel to the circular series of contact points where it makes a sliding contact. The armature of the electromagnet is so designed that for each impulse sent

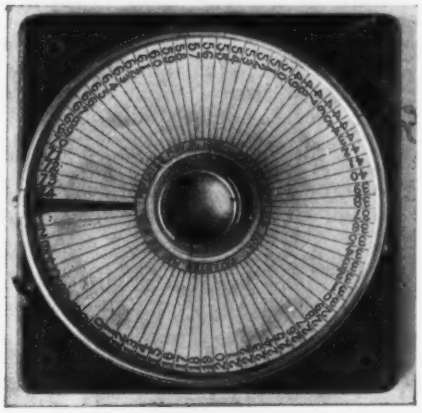


FIG. 2.—CALLING DIAL OR TRANSMITTER.

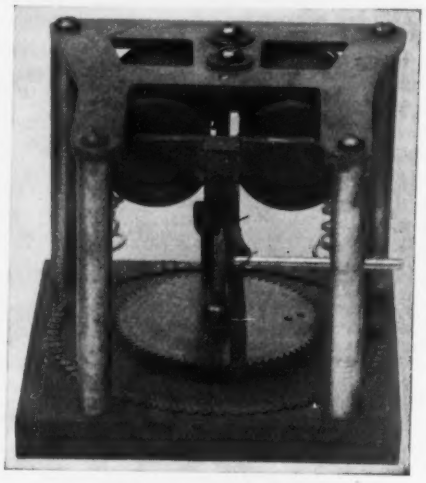


FIG. 3.—AUTOMATIC SWITCH OR RECEIVER.

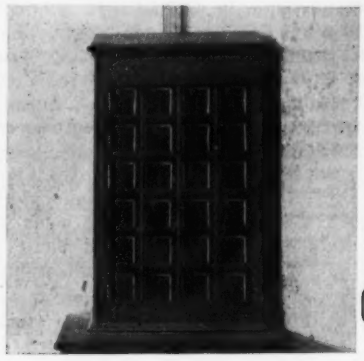


FIG. 5.—MOUNTING FOR AUTOMATIC SWITCHES.

BACK GEARED MOTOR.

through the magnet the switch wheel is moved forward half a tooth, thereby moving the contact spring from one point to the next adjacent one. It will be seen that inasmuch as the number of teeth upon the switch wheel, the number of contact points upon the base of the receiver, the number of teeth upon the periphery of the circuit making and breaking device, and the number of positions on the dial, are all the same, the switch wheel and the dial disk will always be in unison.

To operate this system it is only necessary to press in the little plunger on the side of the dial which normally locks the indicator

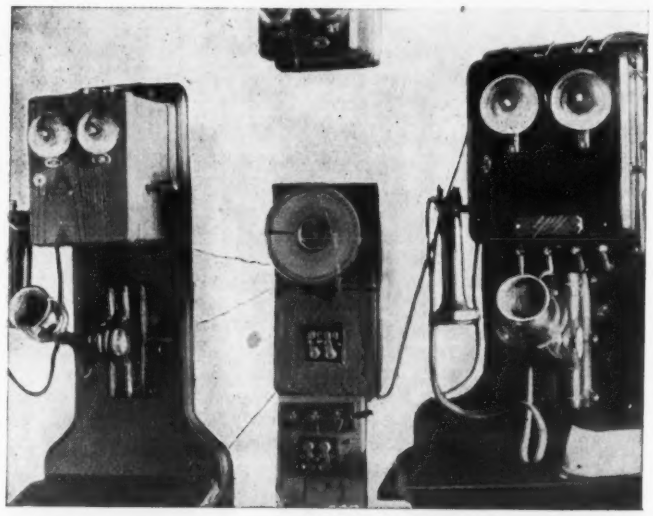


FIG. 4.—LONG-DISTANCE TELEPHONE.

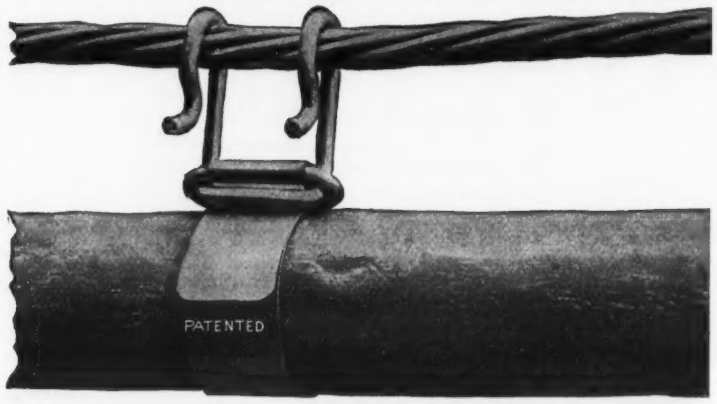
mechanism, set the indicator to the number on the dial it is desired to call, and release the plunger. This operation releases the spring-controlled mechanism in the transmitter, which in turn causes a spring contact to pass over as many teeth on the periphery of the circuit making and breaking wheel as were passed from the normal or zero position on the dial. This spring has in its circuit a battery, and at each make and break of the circuit an electrical impulse is sent through the electromagnet in the automatic switch circuit which in turn by means of its armature forces the switch wheel forward and establishes automatically a connection with the number corresponding to that indicated on the transmitter dial. When the party is through talking it is only necessary to set the dial to its zero position which establishes normal conditions again. Fig. 1 shows a desk stand adapted for use with the Clark apparatus; Fig. 4 shows its adaptation to long-distance telephony, and Fig. 5 illustrates the mounting for the automatic switches.

Back-Geared Induction Motor.

The illustration herewith shows a new type of single-phase alternating current motor designed by the Emerson Electric Manufacturing Company, St. Louis, Mo., for uses requiring slow speeds, such as the operation of linotype machines, to which the motor can be belted direct. The pinion and lower part of the gear are enclosed in a gear case as a protection against accidents. The illustration shows a machine provided with a flat 5-in. pulley with 3-in. face. When desired, a three-cone pulley can be attached to the high speed (armature) shaft. This machine is made for speeds varying from 90 to 360 r. p. m. (slow shaft), and can be used for operating drills, etc., by attaching a Stow flexible shaft directly to the slow shaft of the motor. It is designed for 104 volts, and the sizes range from one-tenth to one-third horse-power.

The Boston Cable Clip.

In the accompanying illustration is shown a clip for the support of aerial cables that possesses the three important requirements in such a device, viz: simplicity, strength and ease of adjustment. The Boston cable clip, as it is called, consists of two pieces of steel wire and a



CABLE CLIP.

strap of sheet metal. It is adjusted entirely by hand, the metal strip being simply pulled tight around the cable before being passed through the hanger. Upon turning over the hanger the strap is bent down and locked in place, the lever action taking up all the slack and binding the strap tightly.

The Chase-Shawmut Company, Boston, Mass., is the manufacturer of this simple clip, which, we are informed, is now exclusively used by many of the largest telephone systems throughout the country.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET.—Increased activity and higher prices is the record for last week's stock market. The favorable conditions are attributed principally to the better ante-election feeling, which promotes a tendency on the part of the public to purchase stocks. Bullish leadership is also said to be a factor in the upward movement of prices. There were substantial advances in the electric and traction securities, particularly in Brooklyn Rapid Transit, which closed the week with a net advance of 5⅜ points. There was great activity in this stock, the sales aggregating 322,507 shares, far exceeding the sales of any other single stock. General Electric remains quite steady, closing with a net gain of ¼ point, the sales being 33,164 shares. Metropolitan Street Railway fluctuated between 163¾ and 157¾, closing with a net gain of 3½ points, the sales being 33,164 shares. Western Union shows a net gain of 1⅜ points. Outside securities.—While the market on the whole was favorable, prices were not so uniformly upward as was the case the week previous. Considering the results obtained, however, the past week's market gives considerable satisfaction, and seems to be an indication of what may be expected in the near future. None of the electrics figured very prominently, but they held their own pretty well. Copper stocks were active and showed considerable strength. Call money closed at 3 per cent, nominal. For time money, the demand was light during the week. The closing rates are 4½ per cent for 30 to 60 days, and 5 per cent for longer periods. In mercantile paper the market was dull, the closing rates being 5@5½ per cent for 60 to 90 days' endorsements, 5½@6 per cent for choice four to six months' single names and 6 and above for others. The following are the closing prices of electric and kindred stocks dealt in at the four cities named:

NEW YORK.

	Oct. 20.	Oct. 27.		Oct. 20.	Oct. 27.
Gen. Elec.	143½	143¾	Elec. Veh.	18	19
Bklyn Rap. Tran.	56¾	62⅛	Elec. Veh., pfd.	*40	30
Met. St. Ry.	157½	161	Gen. Car.	5	4¾
Am. Tel. & C.	89½	—	Ill. Elec. Veh. Tran.	1¼	1¼
West. Un. Tel.	79⅝	81	N. Y. Elec. Veh. Tran.	6¼	7
Am. Dist. Tel.	30	32	N. E. Elec. Veh. Tran.	3⅜	3½
Com. Cable.	160	—	Tel. & Tel. Co. of Am.	5½	5
Elec. Boat.	18½	18½	Hud. Riv. Tel.	116	116
Elec. Boat, pfd.	32	39	N. Y. & N. J. Tel.	160	160

BOSTON.

	Oct. 20.	Oct. 27.		Oct. 20.	Oct. 27.
New Eng. Tel.	—	124	Erie Tel.	—	99¾
Mex. Tel.	—	2⅛	Gen. Elec., pfd.	—	139
Westing. Elec.	—	—	Am. Tel. & Tel.	—	147¾
Westing. Elec., pfd.	64½	62	Ed. Elec. Lt.	—	—

PHILADELPHIA.

	Oct. 20.	Oct. 27.		Oct. 20.	Oct. 27.
Elec. Stor. Bat.	65	75	Phil. Elec.	2⅝	2⅞
Elec. Stor. Bat., pfd.	70	75	Pa. Elec. Veh.	3¼	3½
Elec. Co. of Am.	9⅝	9⅞	Pa. Elec. Veh., pfd.	2	*2
Gen. Elec. Auto.	¼	¼	Am. Rys.	31	31½

CHICAGO.

	Oct. 20.	Oct. 27.		Oct. 20.	Oct. 27.
Chicago Edison.	135	—	Chicago Telep. Co.	205	—
Chic. City Ry.	247	—	Union Traction.	11¾	—
Nat'l Carbon.	16	—	Union Traction, pfd.	48½	—
Nat'l Carbon, pfd.	81	—	Northwest Elev. Com.	23½	—

*Asked.

DIVIDENDS.—The Pittsburg Traction Company has declared the regular semi-annual dividend of 3½ per cent. The Consolidated Traction Company, of Pittsburg, has declared a dividend of 3 per cent on its preferred stock. The Hudson River Telephone Company has declared its regular quarterly dividend of 1¼ per cent. The United Electric Light & Power Company, of Baltimore, has declared a semi-annual dividend of 1½ per cent on the preferred stock. The Bell Telephone Company, of Philadelphia, has declared the regular quarterly dividend of 2 per cent. The Chicago Edison Company has declared the regular quarterly dividend of $2 per share. The National Carbon Company has declared the regular quarterly dividend of 1¾ per cent on the preferred stock, payable Nov. 15. The directors of the New England Telephone & Telegraph Company have declared a regular quarterly dividend of $1.50, payable Nov. 15. The Westinghouse Electric & Manufacturing Company has declared a quarterly dividend of 1½ per cent upon the assenting stock of the company, payable Nov. 15, to stockholders of record. The directors of the Duquesne Traction Company have declared the regular semi-annual dividend of 2 per cent, payable November 6. The directors of Lowell Electric Light Corporation have declared a dividend of 2½ per cent, payable Nov. 1, to stock of record Oct. 24.

MANHATTAN.—The New York *Commercial* claims that the Manhattan Elevated has delayed electrical equipment of its lines for the purpose of using the $18,000,000, secured from the sale of new stock in March, 1899, in the loan market. At the present rate of progress it is claimed it will take years instead of months to electrically equip the system. There is a widespread belief that the Kuhn, Loeb & Company interests have taken an advanced position in Manhattan—perhaps even a controlling position, and that control of the property has changed hands. It is current report that at the time the new stock was offered Mr. Gould and Mr. Sage did not take any of the shares. They, therefore, would not have the control now. One authority goes so far as to say that Mr. Sage's stock has come on the market. The head of a large banking house tells his customers that Metropolitan either has secured or is securing control of Manhattan, and that the property at the present time is no longer controlled as to the majority of shares by the Goulds and Mr. Sage. Electrically considered, Mr. Sage is no loss.

Commercial Intelligence.

THE WEEK IN TRADE.—The general business situation on the whole is encouraging. There have been unseasonable weather conditions during the week, but despite these, manifestations of strength were shown which give encouragement to the general outlook. The ending of the coal strike has decidedly improved the industrial situation, and trade at large will reap the benefit from the return to normal conditions. The gross railway earnings of 30 roads for the third week of October aggregated $5,659,295, a gain of 6 per cent over the same week a year ago. The heaviest gains are those reported by the southwestern and the soft-coal roads. Business failures for the week, as reported by *Bradstreet's*, number 161, as against 223 the previous week, 211 in the same week a year ago, 219 in 1898, 218 in 1897 and 246 in 1896. In the metal market the general tendency has been in the direction of greater activity and strength. Copper is very firm, and prices are unchanged, quotations being 16⅝c. for electrolytic, 16¾@16⅞c. for Lake Superior ingot.

EXPORTS OF ELECTRICAL MATERIAL.—The following were the exports of electrical material from the port of New York for the week just ended: Antwerp—9 packages electric material, $726. Athens—13 cases electric material, $276. Bradford—1 box electric material, $39. British Guiana—38 cases electric material, $1,907. Bristol—54 packages electric machinery, $5,800; 2 packages electric material, $2,540. Bremen—3 cases electric material, $831. Brussels—16 packages electric material, $1,419. Berlin—10 cases electric machinery, $310. Bordeaux—33 boxes motors, $3,000. British West Indies—4 packages electric material, $124. British Possessions in Africa—65 pieces telephone poles, $2,800; 4 cases electric material, $1,101. British East Indies—1 package electric material, $25. Brazil—22 packages electric material, $845; 80 packages electric machinery, $22,149. Cuba—124 packages electric material, $5,143; 3 packages cable, $171; 10,058 packages electric railway material, $113,605. Copenhagen—1 case electric material, $48. Central America—252 packages electric material, $1,792; 1 case motors, $50. Cologne—51 packages electric machinery, $10,657. Dutch East Indies—11 cases electric material, $259. Ecuador—1 case electric material, $20. French Possessions in Africa—14 cases electric material, $2,163. Florence—3 cases electric material, $1,500. Greenock—114 packages electric motors, $1,524; 80 cases electric material, $1,280. Glasgow—2 cases electric material, $46; 1 case electric machinery, $100. Havre—9 boxes electric material, $5,250; 108 packages electric material, $6,181. Hamburg—88 cases electric machinery, $13,050; 16 packages electric material, $569. London—14 packages electric machinery,

$4,464; 12 boxes electric machinery, $850; 39 packages electric material, $7,212. Leeds—9 cases electric material, $671. Liverpool—50 packages electric machinery, $8,572; 32 packages electric material, $4,479; 3 cases automobiles, $500. Mexico—46 packages electric machinery, $6,558; 47 packages electric material, $2,663; 4 cases automobiles, $5,583. Marseilles—29 packages electric material, $303. Newfoundland—31 packages electric material, $545. Nova Scotia—22 packages electric material, $304. Naples—25 cases electric material, $500. Newcastle—17 packages motor machinery, $4,100. Porto Rico —226 packages electric material, $672. Peru—1 package electric material, $5. Rostoff—22 cases electric machinery, $3,531. Southampton —3 packages electric material, $217.

DEVELOPMENT IN MEXICO.—A new company has been formed in Mexico, to erect and operate a plant for the town of Linares, Mexico. The name of the company is Compania Alumbrado Electrica y Fuerza de Linares, State of Neuva Leon, Mexico, which has been organized with a capital of $100,000, all subscribed. It will install a strictly modern and up-to-date plant, consisting of about 2000 16-cp incandescents, 35 arcs, 100 horse-power in small motors and 150 fans. The electrical equipment will consist of two 75-kw, three-phase, 60-cycle, 2300-volt machines and six 25-kw transformers. The steam plant will consist of one 110-hp high-speed Ideal engine, 140-hp Springfield boilers, Stillwell heater and separator, Worthington pumps. The hydraulic plant will consist of one 15-in. McCormick turbine operating under a 50-ft. head, water carried in 36-in. slip-joint pipe a distance of 200 ft. from the reservoir to which the water is brought in a masonry ditch a distance of 3000 ft. from the river. The system of distribution will be three-wire primary with four-wire secondary from a main transformer station in the centre of the city. The power house will be two miles distant in the suburbs. A. W. McLimont, formerly of the General Electric Company's foreign department, is manager and resident engineer under whose supervision the plant will be built and operated.

ELECTRICITY IN PARAGUAY.—Mr. W. Harrison, vice-consul at Asuncion, reports as follows: "The Paraguay Development Company, incorporated with $500,000 capital under the laws of the State of New Jersey and having headquarters in Philadelphia, has been granted by the Paraguayan Government a concession to light the city of Asuncion and to run tram cars by electric power. The concession is for 25 years, and the light and traction service must be open to the public within two years from the date of concession (Aug. 30, 1900). The representative of the company in Paraguay is Mr. Carlos R. Santos, late delegate to the Philadelphia Museum Exposition. In my opinion, the grant is very valuable, and it is probable that other concessions would be given to reliable concerns. The country needs transportation facilities to enable it to exploit its natural resources, and I feel confident that the Government would grant liberal concessions for railways. Industries are unknown in the country, and the Government would welcome and protect the development of almost anything in this line."

BIG PLANT FOR CALIFORNIA.—A special despatch from Hanford, Calif., of Oct. 22, says: The Mammoth Electric Company has been organized here, with a capital of $5,000,000, fully subscribed. The place of business will be Hanford. The officers are as follows: Alex. Guthrie, of Balfour, Guthrie & Company, president; J. Shaw Robertson, vice-president; E. Kauntze, secretary; Bank of Hanford, treasurer. Hugh McCalmont, of England, is one of the heaviest stockholders. The object of the company is to erect the greatest plant for the development of electric power west of the Rocky Mountains, on the San Joaquin River, 180 miles from San Francisco. The company has already sold all power to be developed to San Francisco parties, and a line will be built to San Francisco. J. S. Eastwood, engineer of the San Joaquin Electric Power Company, has been elected civil and hydraulic engineer, and O. M. Lacey, of Hanford, electric engineer of the company.

PNEUMATIC TUBE SERVICE.—Not a few people in the electrical field are watching the development of tube-carrier systems. It is reported from Boston that the work of laying pneumatic tubes there is going on vigorously. The street work is in the hands of the Metropolitan Contracting Company as contractors. Four gangs are now employed and such progress has been made as to make sure that the lines will be finished this season, so that business can be begun early in 1901. President Dillaway is visiting Chicago, Cincinnati and St. Louis, to meet government officials reparding post office lines projected in those cities. Mr. Morrell, the general manager, and one of the counsel of the company, has left for London to close a contract with the British Government for the introduction of a 12-in. system in London.

A TELEPHONE METER COMPANY.—The Automatic Telephone Meter Company, recently incorporated at Orange, N. J., to do a business in telephone-metering instruments, intends to shortly open up an office with exhibit plant at Boston, Mass. The company has secured the control of several broad patents covering its apparatus and states that it will be able to furnish instruments which, while being entirely automatic, will register only "outgoing" calls, and then not unless a connection has been actually completed. It will make its meters adapted to any system, and when desired will make a record not only of the number of calls, but of the actual time the telephone had been in use. Mr. Charles Bate, of Brockville, Ont., president of the company, will in the near future take up his residence in Boston and assume the active management of the business.

PLANT FOR WIRE SCREEN FACTORY.—A direct-current motor equipment has been installed by the Ludlow-Saylor Wire Company, of St. Louis, for its wire screen factory. The generating plant comprises a General Electric 250-volt, 300-ampere, multipolar generator direct connected to an Ideal four-ported, 110-hp engine, 270 r. p. m. Additional power has been provided for in the boiler capacity. All of the motors are 220 volts, and, with the switchboard and meters, were made by the Wagner Electric Manufacturing Company. The plant was designed by Herbert A. Wagner, consulting engineer, St. Louis, and the wiring was done by the Frank Adams Electric Company. Machines in groups are driven by 15-hp motors, and a deep-well Rumsey pump is run by a 5-hp motor.

BELL TELEPHONE CONFERENCE.—Last week there were conferences in Boston of the American Telephone & Telegraph people and the presidents of the following companies: James E. Caldwell, Cumberland Telephone Company; George N. Stone, Bell Telephone Company, of Cincinnati; Charles J. Glidden, Erie Telephone system; John I. Sabin, Pacific States Telephone Company; Charles F. Sise, Bell Telephone Company, of Canada; George Y. Wallace, Rocky Mountain Bell Telephone Company; William A. Jackson, Central Union Telephone Company. The above represent companies operating over 300,000 telephone subscribers for fully 50 per cent of the Bell system in the United States and all of the Canadian system.

TRACTION TRUCKS IN ENGLAND.—The Brush Electrical Engineering Company, Limited, has taken up the manufacture of traction trucks at its Falcon Works, Loughborough, and is thus, it is said, the first and only firm that builds this class of manufacture in Great Britain. The company is at present making three standards, as follows: Four-wheel single type, four-wheel bogie type and the maximum traction type. A special shop has been erected and equipped under the control and management of E. E. Cook, an engineer who has had long and successful experience in this branch of manufacture in the United States. The Brush Company is now in a position to quote on any specification and to handle orders of any magnitude.

THE NEW ENGLAND MOTOR COMPANY has recently installed one of its 35-hp motors in the sawmill of J. P. Rust, at Keene, N. H. The motor is rigidly coupled to a 48-in. Chase sawmill and is an interesting example of direct connected work. The saw has a speed of 800 r. p. m. The normal rating of the motor is 135 amperes at 220 volts. The installing engineer says of the machine: "The load of the motor when not sawing is 50 amperes; when sawing medium-sized logs it takes about 150 amperes, but frequently jumps to 210; but the motor gives no trouble about it even then, and I have not as yet seen it spark in the least."

TELEPHONES FOR MANILA.—The United States Government has arranged to put in a telephone service in the Philippine Archipelago. The Lambert Schmidt Manufacturing Company has been awarded a contract to supply $10,000 worth of telephone instruments, and to ship them to Manila as soon as possible. To carry out this order quickly the company has had 100 extra men at work, and ordered the employees to work from 13 to 14 hours daily, with extra pay. The Government plan is to have the telephone service extended not only throughout Luzon, but to connect Manila with as many other islands as possible.

THE CARPENTER ENCLOSED RESISTANCE COMPANY is the name of a new company in the electrical field. It is headed by Mr. C. E. Carpenter, who has been for several years with the Ward Leonard Electric Company, and is well known as an inventor of modern types of resistances. The new company, it is stated, is strongly backed financially. The factory is located at 130th Street and Park Avenue, New York, and is being fully equipped with new machinery designed specially for its purpose. The company will manufacture a full line of electric heating apparatus, including flat irons, soldering irons and special electric heating devices.

POWER IN THE SOUTH.—It is stated that the Indianola Power Company has contracted with Ladshaw & Ladshaw, of Spartanburg, S. C., for the development of the Landsford water-power on the Catawba River. It is said that 10,000 horse-power is available. The current is to be furnished to cotton factories and other industries in the neighborhood.

HOOPES & TOWNSEND, of Philadelphia, Pa., have contracted with the American Bridge Company to build a bar mill building 70 ft. x 500 ft. on the line of the Trenton cut-off of the Pennsylvania Railroad.

THE WESTERN ELECTRIC COMPANY has just shipped a large number of its Petite direct-current arc lamps to Australia; also a number of the series enclosed arc lamps to South America.

General News.

THE TELEPHONE.

(See Supplement.)

ELECTRIC LIGHT AND POWER.

KUTZTOWN, PA.—The Kutztown Electric Light Company has purchased land upon which to erect a plant.

HAVRE DE GRACE, MD.—A Westinghouse 30-kw single phase generator, exciter and switchboard are being installed in the city plant.

RADFORD, VA.—The Radford Electric Light & Power Company is building a power plant and will furnish power to manufacturing enterprises.

MT. GILEAD, OHIO.—John C. Fish, of Shelby, has been granted a franchise for the installation of an electric lighting plant and water works.

RALEIGH, N. C.—The Raleigh Ice & Electric Company is installing two 220-kw, 6600-volt, rotary field Westinghouse machines, for its six-mile transmission line.

CORSICANA, TEX.—The Mayor has recommended that the city build and operate an electric light plant, put in electric fire alarm system and make other improvements.

CHRISTIANSBURG, VA.—The city electric light plant is installing a Westinghouse 45-kw, single phase, alternating current generator and 25 Manhattan series arc lamps.

BALTIMORE, MD.—Charles E. Cassell is preparing plans for a two-story brick power-house for Hochschild, Kohn & Company. New boilers, dynamos, etc., will be installed.

PLAINFIELD, N. J.—The Manhattan Heating, Lighting & Ventilating Company has been incorporated. Capital, $100,000. Incorporators: F. McKeigh, S. T. Williams, J. L. Edsall.

WARREN, O.—The Economy Electric Company has been organized here. The stockholders are P. L. Webb, George H. Jones, W. H. Smith, G. B. Sawyer and J. W. Powers.

JOHNSTOWN, PA.—The Johnstown Steam Heat & Power Company has been granted a charter. Its capital stock is $35,000. Its plant is part of that of the Johnstown Electric Light Company.

HARRISONBURG, VA.—In addition to the two units previously installed in the city electric light plant, a third unit has been contracted for. It will be a Westinghouse 60-kw. alternating current, 1100-volt, single-phase generator.

LIMA, OHIO.—A new company, to be known as the People's Electric Light Company, headed by A. L. White and W. T. Agerter, local capitalists, has made application for a franchise. If the franchise is granted a large plant will be erected.

WELDON, N. C.—The Roanoke Navigation & Power Company has purchased two 200-kw alternating current two-phase generators, 440 volts for its 4-mile transmission line. The voltage is transformed to 6600 volts, three-phase and stepped down to meet requirements.

NAVASOTA, TEX.—The Southern Electric Light Company will build a plant at Navasota to operate twenty-five 1000-candle-power arc and 2000 16-candle-power incandescent lights. A new telephone system will also be constructed. W. H. Freeman of Rosebud, Tex., is interested.

SAN FRANCISCO, CALIF.—The Independent Electric Light & Power Company, San Francisco, recently installed a 400-kw, 500-volt rotary transformer, of Westinghouse manufacture, in the Eighth Street sub-station. It will operate the cars of the San Francisco & San Mateo Electric Railroad.

DES MOINES, IOWA.—The City Council passed the electric light underground conduit ordinance over the Mayor's veto. The passage of the ordinance means that the electric light company will at once begin to put its wires under ground, and that soon after every company in the city must follow suit.

RADFORD, VA.—The Radford Electric Light & Power Company recently purchased Westinghouse apparatus as follows: One 100-kw railway generator, one 75-kw alternating current two-phase generator besides 50 Manhattan series are lamps, and two regulators. These will be used on its 4-mile transmission line.

YOUNGSTOWN, OHIO.—The Eastern capitalists who recently secured control of the Youngstown Gas & Electric Light Company have succeeded in purchasing the Kaercher Electric Light & Heating Company, the rival of the former company. The purchase price is said to have been $30,000. The two plants will probably be consolidated.

MANSFIELD, OHIO.—The stockholders of the Mansfield Electric Light & Power Company elected officers as follows: Directors—James P. Seward, Joseph S. Hedges, John McIlhenny, H. E. Bell, E. H. Keiser and William C. Hedges; president, H. M. Weaver; vice-president, J. P. Seward; treasurer, Joseph S. Hedges; secretary and superintendent, William C. Hedges.

WELDON, N. C.—The Roanoke Navigation & Water Power Company is installing two generators of 500 horse-power each. Power will be conveyed to the mills of the Patterson Textile Company, a distance of two and one-half miles, and to the town of Weldon, for lighting purposes. As noted in last week's issue, Messrs. Morton, Reed & Company, of Baltimore, have the contract and will install Westinghouse apparatus and S. Morgan Smith water wheels. The electric plant will be of 1000 horse-power. The company obtains about 20,000 horse-power from a canal built in 1812, the water being drawn from the Roanoke River. It furnishes water power with sites on the railroad for $15 per horse-power per year, 24 hours daily.

THE ELECTRIC RAILWAY.

CINCINNATI, OHIO.—Col. John P. Martin of Xenia is promoting a project for an extensive electric system in this portion of the State.

DAYTON, OHIO.—The Dayton & Maysville Electric Railway Company has been incorporated with a capital stock of $10,000 by M. V. Whittaker, S. Woodward, E. D. Smith, F. M. Cowden, M. H. Blair, H. Rice, W. L. Day and I. F. Welch.

CLEVELAND, OHIO.—The Railway Construction Company of this city has been incorporated by Frank H. Ginn, Allison J. Thompson, V. F. Buhnard, John M. Garfield and Frank M. Cobb to construct and equip electric and steam railways. The capital stock is $10,000.

BUENA VISTA, PA.—In the power house of the Yough Valley Electric Railroad Company at this place the boiler burst on Oct. 12 while the men were cleaning it. The explosion demolished the entire power house. Walter Reedy, an employee of the company, was badly injured.

DURHAM, N. C.—A 12-mile electric railway is still being agitated to be run between Durham, N. C., and Chapel Hill, C. L. Lindsay, of the latter place, being interested. It is stated that a proposition looking to something definite will soon be laid before the people of Durham by those interested.

CONCORD, N. H.—At the annual meeting in this city of the stockholders of the Concord & Montreal Railroad, it was unanimously voted to authorize the building of a branch line from Concord to Hudson, to be operated by electricity, and to issue bonds for the construction thereof to an amount not to exceed $1,000,000.

KENT, OHIO.—Business people have entered a protest against granting a franchise to the Portage Lakes Traction Company because of the circuitous route between Twin Lake and Kent. It is claimed that the farmers north of the city will be able to go to Ravenna quicker than to Kent, taking business away from the latter place.

CLEVELAND, OHIO.—The Western Ohio Railway Company will be incorporated within a few days, with a capital stock of $500,000, to build an electric line from Lima to Wapakoneta, this State, a distance of about 30 miles. The company is composed of Cleveland and Akron people, and is said to be headed by Henry Everett, of this city.

PETERSBURG, VA.—Mr. Augustus Wright, president of the South Side Railway & Development Company, of Petersburg, Va., is reported as saying that a recommendation would be made at the next meeting of the stockholders for an extension of the system and the establishing of a park, the proposed improvements to cost between $100,000 and $150,000.

SHARON, PA.—Townsend, Reed & Company, of Chicago, have closed the deal by which they come into possession of the Valley Street railroad, rolling stock and other properties between here and Sharpsville. They also purchased the franchises of the Sharon & Wheatland Electric Railroad and secured certain rights in the Youngstown and Sharon proposed electric lines.

PITTSBURG, PA.—J. M. Camden, who is the head of the Southern Traction Company, of Huntington, Ky., was in this city last week, and purchased some additional machinery for the operation of his electric road. This road is operated by the Westinghouse alternating-current system. The road is single track and 30 miles long, running from Huntington to Ashland, Ky.

TOLEDO, OHIO.—The Lucas County Commissioners have granted a franchise to a new company to be known as the Shore Acres Company which proposes to build an electric line from Toledo to Point Place on the lake shore where a summer resort is to be located. The company will be incorporated with a capital stock of $100,000 by Otto K. Shymanski, Julien T. Cockerill, Clarence D. Biggs and others. Arrangements will be made with the Toledo Traction Company for entrance into the city and for the use of power.

OBITUARY.

MR. GEO. J. PERCIVAL, consulting engineer of St. Louis, died Oct. 24.

MR. G. W. GARDANIER.—It is with much pain that we record the death, by suicide, of Mr. George W. Gardanier, first assistant to Mr. A. S. Brown, chief electrical engineer of the Western Union Telegraph Company. He had been in low spirits for some time past and is supposed to have been temporarily deranged. He had suffered from nervous prostration during the past summer, and had worried about his condition. Mr. Gardanier had held his position for over ten years past. He was a member of the American Institute of Electrical Engineers and the New York Electrical Society, but was not widely known, being an amiable man, but of retiring disposition.

PERSONAL.

MR. F. S. TERRY, vice-president and general manager of the Sunbeam Incandescent Lamp Company, made a visit to Chicago recently.

MR. L. W. GILL, B. A. Sc., of Montreal, has been appointed lecturer in the newly created chair of electrical and mechanical engineering in the Kingston (Ont.) School of Mining.

MR. S. W. MOON, formerly secretary and general manager of the Swedish-American Telephone Company, has disposed of his interest in that company and has accepted the position of sales manager of the Stromberg-Carlson Telephone Manufacturing Company.

MR. R. LESTER THAYER, contracting electrical engineer of Peoria, Ill., was married Oct. 25, 1900, at Shelbyville, Ind., to Miss Gertrude Garner. All his friends join in hoping that this latest contract of Mr. Thayer's will prove the most successful and happy one he has ever made.

MR. A. F. LAWRENCE, formerly of Chicago, who is known in electrical circles through his connection with the patent business of the Western Electric and Siemens & Halske companies, has opened an office for the practice of patent law at 1410 Williamson Building, Cleveland.

MR. F. M. CLARK, who for the past eighteen months has taken orders in the Southern States for the H. T. Paiste Company, has severed all connection with that company. Mr. C. I. Hills, general sales agent for the company, will in the future look after its business in that section.

WALBRIDGE—TAYLOR.—The marriage is announced of Mr. George Hicks Walbridge to Miss Mary Gilley, daughter of Mr. and Mrs. James B. Taylor. The bridegroom is well known in electrical circles as New York manager and member of the prominent electrical engineering firm of J. G. White & Co., and the event gives a great deal of pleasure to his wide circle of friends.

MR. J. L. PUTNAM, formerly connected with the American Telephone & Telegraph Company, has accepted the position of chief engineer with the Clark Automatic Telephone Switchboard Company, of Providence, R. I. In his present capacity Mr. Putnam has full charge of all construction work and the installation of apparatus. He anticipates that the field will be one of unusual activity. His many friends extend their hearty congratulations and wish him success in his new connection.

Trade Notes.

THE AMERICAN BRIDGE COMPANY is furnishing from its Minneapolis plant the structural steel for the roof of the State Hospital at Glenwood, Ia.

THE PRESSED STEEL CAR COMPANY, McKees Rocks, Pa., has just ordered two very large Cross oil filters from the Burt Mfg. Co., Akron, Ohio.

THE ABBOTT ELECTRIC & MANUFACTURING COMPANY, Cleveland, Ohio, has under consideration a proposition for the removal of its plant and business to Circleville, Ohio.

ELECTRIC TROLLEY HOISTS AND TRAVELING HOISTS.—The Sprague Electric Company, New York, in Bulletin No. 203, describes and illustrates its electric trolley hoists and electric traveling hoists.

MR. C. E. McSHANE, of the New Excelsior Dry Battery Manufactory, New York, has gone on a five weeks' trip to the South and West in the interest of this company's battery, which is meeting with quite a large sale for telephone, telegraph and gas engine purposes.

SCHOOL OF TELEPHONY.—The International Correspondence Schools, Scranton, Pa., teach a course in telephony among their numerous other courses. This course gives instruction as to the installation and maintenance of telephone systems, and is described in an illustrated circular issued by the Schools.

THE FALCON ELECTRIC MANUFACTURING COMPANY, 432 to 436 East Seventy-first Street, New York, is much gratified at the success with which its new arc lamp is meeting. This lamp is in line with its various other specialties, fan motors, power motors, attaching plugs and receptacles, switchboards, panel boards, etc. It may be noted that the company carries in stock a full line of various sizes in panel boards for immediate service.

THE CLING-SURFACE MANUFACTURING COMPANY has opened a branch office in the Bourse Building, Philadelphia, Mr. H. P. Childs being in charge. The company reports that the demand for Cling-Surface has never been so great as it is at present, for electrical and manufacturing plants all over the country are discovering that Cling-Surface allows them to run their belts free from slipping, and easy, and avoid the constant trouble which tight belts cause.

WESTINGHOUSE RAILWAY MOTORS.—Under the title of "Westinghouse Railway Motors," a pamphlet has been issued by the Westinghouse Electric & Manufacturing Company. It contains illustrated descriptions of the standard Westinghouse railway motors, together with a few illustrations of typical railway power stations. Copies will be mailed to officers of electric railways, consulting and contracting engineers and others interested, upon application.

THE CARLETON WINDOW LOCK which the Western Electric Company is now handling, is a positive burglar alarm and window lock combined. By means of this device a window can be left open for ventilation, but cannot be moved from this position by any person outside of the same. Any attempt to move it rings a bell in the house. Being a positive lock and burglar alarm combined, it fills a long-felt want, and is the only article of its kind on the market. It has already been fully illustrated and described in these pages.

LARGE DRY BATTERY ORDER.—What is said to be the largest order for dry batteries ever given by a single concern has just been placed with William Roche, the manufacturer of the New Standard dry cell. The order was from a large Western user for half a million of the No. 2 telephone size. Mr. Roche reports business at present as the most prosperous in all his experience, and his increased facilities enable him to fill all orders promptly. The new Autogas dry battery for gas engine ignition is said to be meeting with gratifying success and wherever used duplicate orders are the result.

ENCLOSED TYPE STARTERS.—A note from the Ward Leonard Electric Company says: "Among the improvements in the motor starting rheostats during recent years, the construction known as the 'enclosed type' has been one of the most important ones. So important is this considered in England that the 'enclosed type' of resistance is universally required in all the principal cities, especially on account of the fire risk. One of the simplest and best forms of enclosed type starters is that in which the resistance material in the form of a wire for small currents, and in the form of a metal ribbon for large currents, is embedded in pure white sand contained in a cast-iron case. This form of starter was first placed on the market about two years ago by the Ward Leonard Electric Company, and it was fortunate enough to secure a gold medal at the Paris Exposition for its apparatus. A patent covering this type of starter was issued last month to H. Ward Leonard after quite a long delay in the Patent Office. The claims of the patent seem to cover quite broadly the use of sand or equivalent material in a motor starter of the customary commercial type."

THE ELECTRICAL ENGINEER INSTITUTE.—The advent of the season for home study and self-improvement has made itself felt in no quarter more than among the ranks of electrical workers. This is manifest from the large number of students who have recently enrolled in the Electrical Engineer Institute of Correspondence Instruction. These aspirants after increased knowledge include workers in every department of electrical industry and application, the twenty electrical courses taught by the Institute making it possible for the student to select just what he most desires. Besides the regular courses in electrical engineering, central station practice, electric light and power, electric railways, telegraphy, etc., the Institute has a most complete course in telephony. The latter gives the fullest possible instruction in the latest standard practice of the art, including both Bell and independent apparatus, together with full details on overhead and underground line construction, cables, safety devices, etc. All the courses of the Institute have been prepared by experts and are described in detail in the new edition of the booklet just issued, entitled, "Can I Become an Electrical Engineer?" which can be had free by addressing the Electrical Engineer Institute, 240-242 West Twenty-third Street, New York.

THE WESTERN ELECTRICAL SUPPLY COMPANY, of St. Louis, has recently taken the exclusive agency for the Western Telephone Construction Company, of Chicago, for a very large territory. This apparatus embodies everything in telephone and switchboard construction, including the new Western express and multiple boards. The company reports its telephone department as being crowded with orders, and has been pushing this department of its business and using every possible means to keep strictly up to date on anything pertaining to the equipment, operation or maintenance of a telephone line or exchange. Being general electrical supply dealers, as well as manufacturers, has necessarily given the company a most decided advantage over the strictly telephone manufacturers. The company is prepared to equip lines and exchanges with a complete equipment of construction material and telephones from stock, switchboards on short notice, being always able to guarantee prompt and satisfactory shipments, which is an item of the utmost importance. Any one contemplating installing a telephone exchange and line, or that is interested in telephones, will find it to their advantage to examine this apparatus.

Record of Electrical Patents.

UNITED STATES PATENTS ISSUED OCT. 23, 1900.

[Conducted by William A. Rosenbaum, Patent Attorney, Times Bldg., N. Y.]

660,113. PANEL BOARD AND FUSE HOLDER; C. J. Klein, New York, N. Y. App. filed March 14, 1900.

660,114. PROCESS OF MANUFACTURING INCANDESCENT BODIES; R. Langhans, Berlin, Germany. App. filed Feb. 13, 1900. According to this invention definite proportions of thoria and ceria are caused by the agency of an alkaline oxide to chemically combine as basic components with definite proportions of silica and zirconia as acid components, whereby a compound is formed having the nature of a glass, being a silica-zirconiate of thorium and an alkaline metal containing some ceria and which on exposure to the Bunsen flame radiates a brilliant light.

660,116. PROCESS OF SEPARATING TIN FROM TIN SCRAP; O. Meyer, Richmond, Va. App. filed Nov. 20, 1899. Consists in subjecting the scrap to a strong bath of muriatic acid which will not attack the tin, but which will attack the iron after the tin is removed and form protochlorid of iron—an electrolyte; connecting the tin scrap with the positive pole of an electric generator and forming an anode, and connecting a sheet of metal with the negative pole and forming a cathode, and subjecting the scrap to an electric current.

660,119. ALARM APPLIANCE FOR REFRIGERATOR PANS; J. H. McGurty, Jersey City, N. J. App. filed June 14, 1900. A detachable appliance including a circuit maker and breaker adapted to be operated by a float in the pan to indicate when the pan should be emptied.

660,124. TELEPHONE SYSTEM; L. Schmidt, Weehawken, N. J. App. filed March 8, 1900. Relates to intercommunicating systems in which each party calling makes connection at his own station or instrument with the station or instrument of the party called.

660,134. AUTOMATIC CIRCUIT BREAKER AND CLOSER; W. B. Watzel and F. L. Shekell, Washington, D. C. App. filed Jan. 4, 1900. A vessel shaped like an hour-glass and containing mercury is pivoted so as to be tilted under magnetic influence when the circuit is closed. Normally the tilting will be but momentary. Should there be a ground, however, the vessel will remain tilted and the mercury will pass from one end to the other and break the circuit.

660,138. THERMO ELECTRIC CELL; E. F. Yost and W. H. Smith, New York, N. Y. App. filed June 28, 1900. A thermo electric cell having a joint between the elements of the thermo electric couple, whereat temperature differences produce differences in electrical potential. A shield is interposed between said elements at said joint and constructed of electrically conducting material incapable of attacking either of said elements.

660,139. THERMO ELECTRIC CELL; E. F. Yost and W. H. Smith, New York, N. Y. App. filed June 28, 1900. In a thermo electric cell a body of electronegative metal, an outer covering of electropositive metal, and a contact piece of electropositive metal embedded in said negative metal and electrically connected at its ends to said electropositive metal.

660,140. INSULATOR; C. Alley, Pendleton, Ind. App. filed April 9, 1900. Details.

660,152. ELECTRIC WELDING TONGS; J. R. Duncan, Indianapolis, Ind. App. filed May 17, 1900. Relates to insulation of the two jaws and their handles.

660,154. RECEPTACLE FOR INCANDESCENT LAMPS; P. H. Feilding, New York, N. Y. App. filed April 2, 1900. In general the invention consists of a receptacle comprising two parts, an inner part and an outer part, the latter acting as a shield for the former and all contacts being so located that the wires of the circuit can be stripped of their insulation for a short length and connected with said contacts, thus avoiding the operation heretofore necessary of making half-splices and leading the branches to the contacts.

660,155. APPARATUS FOR CONTROLLING MECHANISM OF MOVING VESSELS OR VEHICLES; B. A. Fiske, U. S. Navy. App. filed Sept. 7, 1898.

660,156. METHOD OF CONTROLLING MOVING VESSELS OR VEHICLES; B. A. Fiske, U. S. Navy. App. filed April 2, 1898.

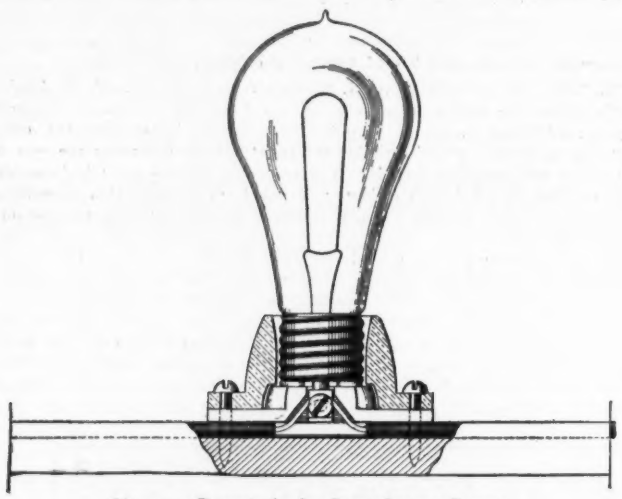
660,199. TELAUTOGRAPH OR FAC SIMILE TELEGRAPH; A. Pollak, Szentes, Austria-Hungary. App. filed May 25, 1898. Provides apparatus whereby a true photographic reproduction of the telegram sent out from the transmitting station is produced at the receiving station. The picture of the dispatch is projected onto a series of selenium cells and affects the resistance of a current which is passed through them. This current at the receiving station vibrates diaphragms similar to those in telephones, the vibrations being used to control the light admitted to a traveling sheet of prepared paper. An exact copy of each single point of the dispatch being obtained results in a copy of the whole dispatch.

660,217. ELECTRIC MOTOR WHEEL; C. E. Isbills, Passaic, N. J. App. filed Dec. 13, 1899.

660,228. PLATE OR ELEMENT FOR STORAGE BATTERIES; E. A. Sperry, Cleveland. App. filed March 26, 1900.

660,268. INDICATOR; C. L. Clarke, Mount Vernon, N. Y. App. filed Jan. 17, 1900. An indicating apparatus in which the stroboscopic principle, or principle of observing moving objects through moving apertures is used.

660,271. INSULATING KNOB FOR ELECTRIC LIGHT WIRING; R. H. Henderson and J. G. Henderson, Chicago, Ill. App. filed Dec. 10, 1897. An insulating knob with a groove for a wire like an ordinary knob, with a hook curved over from its outer end, forming a cavity underneath large enough to receive the required wire, in such proximity to the groove that when the end of a wire is placed underneath this hook and the wire wrapped around the knob in the groove it effectually shuts in the end of the wire so that it cannot be pulled out.



660,154.—Receptacle for Incandescent Lamps.

660,293. ELECTRIC METER; T. A. Edison, Llewellyn Park, N. J. App. filed Sept. 16, 1899.

660,305. THERMO-ELECTRIC BATTERY; J. Oliver, Memphis, Tenn. App. filed Feb. 8, 1900. A thermo-electric battery having the elements extending substantially radially, and with the positive elements located in one plane and the negative elements in a different, but substantially parallel plane.

660,313. LIGHTNING ARRESTER; C. J. Reed, Philadelphia, Pa. App. filed Feb. 17, 1899.

660,320. SYSTEM OF ELECTRICAL DISTRIBUTION; C. I. Young, Philadelphia, Pa. App. filed March 6, 1900. Relates to a "three-wire" system in which the voltage of the current on either side of the circuit is automatically adjusted relative to the load thereon.

660,340. SAFETY CUT-OUT FOR ELECTRIC CIRCUITS; J. Sachs, Hartford, Conn. App. filed July 10, 1899. The fuse wire is surrounded by a tubular casing in which is an opening in its side. The blowing of the fuse is visually indicated by the discoloration of the walls about said opening.

660,341. SAFETY FUSE; J Sachs, Hartford, Conn. App. filed Nov 24, 1899. A safety fuse comprising a case and a filling of non-conducting material and a fuse strip therein of thin flat metal of extended area.

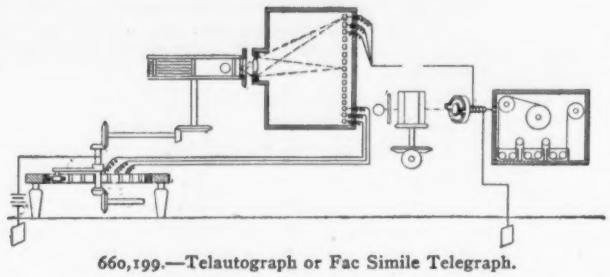
660,352. ELECTRIC TEMPERATURE INDICATOR; L. S. Wilder, Springfield, Mass. App. filed Feb. 17, 1900. Details.

660,375. ELECTRIC BATTERY; F. K. Irving, Newark, N. J. App. filed March 19, 1900. A battery electrode consisting of metallic strips or bands, arranged upon each other "log-cabin" fashion, and forming a central open space.

660,385. SELF-WINDING ELECTRIC CLOCK; A. J. Madden, Prahran, Victoria. App. filed Dec. 23, 1899. Details.

660,393. ELECTRIC ARC LAMP; J. J. Rathbone, London, England. App. filed Feb. 24, 1900.

660,396. ELECTRIC REGULATOR; C. W. Richards, Needham, Mass. App. filed Aug. 21, 1899. In accordance with this invention, a motor is geared directly to the movable member of a rheostat in the dynamo-circuit, the said motor being under the control of a solenoid, also in the dynomo-circuit, the core of which solenoid is arranged by its movement in one direction to connect the motor-terminals in such a way as to cause the motor to travel in one direction and by its movement in the other direction to so connect the motor-terminals as to cause the motor to travel in the opposite direction. The solenoid is normally balanced, so as to cut the motor out altogether.



660,199.—Telautograph or Fac Simile Telegraph.

660,400. VALVE; R. J. Smith, Sunderland, England. App. filed Oct. 16, 1899. Relates to automatically closed flap or similar valves located in steam pipes or other working fluid passages and designed to be closed in emergencies by the simple release of a catch or holding device.

660,416. MANUFACTURE OF REFLECTORS; Sherard Osborn Cowper-Coles, London, Eng. App. filed Nov. 7, 1898.

660,439. INDIVIDUAL CALLING APPARATUS; G. B. Hommam, Colorado Springs, Colo. App. filed Sept. 11, 1899. Relates to what is known as "individual calls" by means of which the call used for any station or operator on a telegraph line may be used to ring a bell or operate some other audible or visual signal without bringing into operation similar signals at other stations on the same line.

660,459. SLOT WEDGE FOR DYNAMO ELECTRIC MACHINES; H. G. Reist, Schenectady, N. Y. App. filed Aug. 21, 1900. Wedges of laminated magnetic material for closing the coil-retaining slots of dynamo electric machines.

660,469. SIGNALLING SYSTEM; E. J. Silkman, Baltimore, Md. App. filed March 25, 1898. Consists in transmitting signals by semaphore or such devices and making the signals manifest at the receiver in the form of letters or other symbols. This is accomplished by means of a rotating disk whose motion through any predetermined angle is used to indicate a letter, numeral or other symbol previously agreed upon.

660,470. SYSTEM OF SIGNALLING; E. J. Silkman, Baltimore, Md. App. filed March 13, 1899. (See preceding patent.)

660,475. MANUFACTURE OF INCANDESCING ELECTRIC LAMPS; W. L. Voelker, London. App. filed Nov. 20, 1899. The method of manufacturing electric lamps, consisting in forming a bulbous body with two extensions having an air space between them, thus introducing a loop-shaped filament so that the legs thereof respectively occupy the said extensions and are sealed therein, and then closing the bulbous part of the chamber and exhausing the same.

660,483. TRANSMISSION OF POWER; E. J. Berg, Schenectady, N. Y. App. filed Aug. 16, 1899. Comprises a source of alternating current, a plurality of rotary converters fed through separate transmission lines running back to said source, conductors connecting together the direct-current terminals of the converters, and conductors connecting together the alternating current terminals of the converters.

660,487. ELECTRIC BRAKE; F. E. Case, Schenectady, N. Y. App. filed Aug. 5, 1898. The brake shoe is applied to the outside of the wheel, the wheel being provided with a properly machined surface. The shoe is adapted to follow the end play of the axle, so as to avoid variations of the air gap.

660,502. SYSTEM OF MOTOR CONTROL; A. S. Garfield, Paris, France. App. filed March 11, 1899. Is adapted to those cases in which heavy trains are to be moved by a plurality of motor cars which may be interspersed throughout a train with cars having no motors. An indicator on one of the cars is arranged to indicate only current flowing in circuits of said car, and an indicator on another car is arranged to respond to flow of current in circuits of a car other than that on which it is placed.

660,534. REGULATING DYNAMO ELECTRIC MACHINES; C. P. Steinmetz, Schenectady, N. Y. App. filed Aug. 18, 1899. The regulation of the machine or machines is performed indirectly by regulating the exciter, the regulation of the latter being effected by passing alternating current from the mains of the machine to be regulated through the armature of the exciter, thereby producing in the exciter an armature reaction having a component acting to vary the field of the machine to be regulated.

11,865 (reissue). METHOD OF INSULATING ELECTRIC CONDUCTORS; N. Tesla, New York, N. Y. App. filed Aug. 14, 1900. This method consists in insulating an electric conductor by freezing or solidifying and maintaining in such state the material surrounding or contiguous to the conductor, using for the purpose a gaseous cooling agent circulating through one or more suitable channels extending through or in proximity to the said material.

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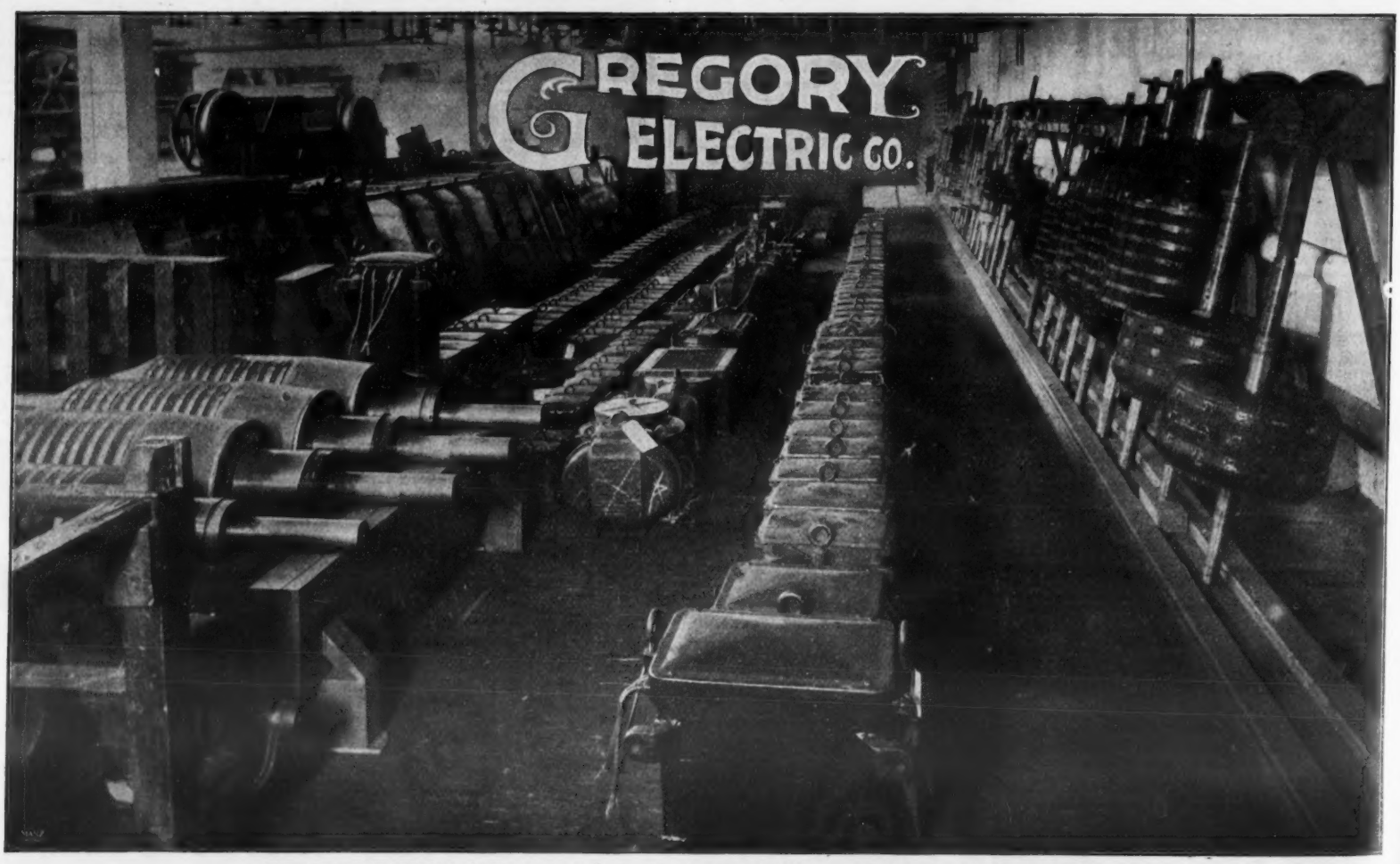

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2 150-kw Edison Bipolar.
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2 45-kw Edison Bipolar.
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4 25-kw " "
2 20-kw " "
3 15-kw " "
2 10-kw " "
1 100-kw M.P., 6, Westinghouse.
2 45-kw comp. Westinghouse, M. P., 4.
2 60-hp M.P., 6, Westinghouse.
1 500-ampere Onondaga.
1 25-kw Electro Dynamic.
1 30-kw Western Electric, M.P., 500 r. p. m.
1 45-kw General Electric, M.P., 850 r. p. m.

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220 VOLTS.
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1 75-kw General Electric, direct-connected to Ideal engine.

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1 70-kw, M.P. Siemens-Halske (new).
1 65-kw Siemens-Halske.
1 25-hp Sprague, bipolar.
1 15-hp Perrett, M.P.
1 10-hp Eddy, bipolar.
1 5-hp Eddy, bipolar.

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2 60-kw Edison.
2 50-hp, M.P., General Electric, type H.
1 10-hp Eddy.
1 2-hp Cent. Elect. Co.

RAILWAY GENERATORS.

1 500-kw M.P., 4, Gen Electric.
1 300-kw M.P., 4, Gen. Electric.
1 200-kw M.P., 4, Walker.
1 111-kw M.P., 4, Westinghouse.
1 100-kw M.P., 4, Gen. Electric.
1 100-kw B.P., Fort Wayne.

ALTERNATORS.

1 325-kw Siemens & Halske, 2000 volts, 7200 alternations, single phase.
1 300-kw Fort Wayne, 2000 volts, 7200 alternations, single phase.
1 240-kw Stanley, two-phase, 380 r. p. m., with engines direct-connected.
1 240-kw Westinghouse, 110 volts, 16,000 alternations, single phase.
1 220-235-kw Westinghouse, single phase, 1100 volts, 450 r. p. m., 7200 alternations.
1 150-kw Westinghouse, two-phase, 1100 volts, 600 r. p. m., 7200 alternations.
2 A-120 General Electric, single phase, 1000 volts, 16,000 alternations.
2 90-kw Gen. Elec., single phase, 1000 volts, 16,000 alternations.
2 120 Westinghouse, single phase, 1100 volts, 16,000 alternations.
2 100-kw monocyclic General Electric, 1050 volts, 7200 alternations, with exciters.
1 60-kw General Electric, single phase, 2000 volts, 16,000 alternations.
1 75-kw Stanley, 2000-1000 v., two-phase, 16,000 alternations.
1 60-kw Stanley, two-phase, 2000-1000 volts, 7200 alternations.
1 200-hp Westinghouse motor, two-phase, 3000 alternations, 400 volts, shaft 4¾-inch diameter, pulley 25-inch face, 30-inch diameter.
1 45-kw Westinghouse, 2200 volts, 16,000 alternations.
1 110-kw Fort Wayne, 2200 volts, 16,000 alternations.

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1 10 x 12 Watertown.
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1 12-light Hartley, self-oiler, M.P.
1 12 " Edison, ¾ K.W., self-oiler.
1 25 " Edison, 1½ K. W., self-oiler.
1 50 " Hawkeye.
1 50 " Card, self-oiler.
1 50 " Nowotny, self-oiler.
1 50 " C. & C., self-oiler.
1 50 " Mather.
1 60 " Thomson-Houston, comp.
1 70 " Crocker-Wheeler, slow speed.
2 90 " Westinghouse, self-oilers.
1 100 " J. & C., self-oiler.
1 125 " Crocker-Wheeler, self-oiler.
1 160 " Card, self-oiler.
1 150 " Edison self-oiler, 8¼ K.W.
2 180 " Siemens & Halske, M.P.
1 200 " Western Electric, s. o., comp.
2 210 " Edison, self-oilers, 12 K.W.
1 250 " Westinghouse.
1 250 " Commercial, comp., s. o.
1 250 " Eddy, self-oiler.
1 270 " General Electric, 15 K.W., M.P., direct connected.
1 270 " Northern, M.P., comp., s. o.
2 270 " Westinghouse, M.P.
1 300 " Jenney, self-oiler, compound.
1 300 " Columbian, M.P., comp.
1 340 " Eddy, self-oiler, compound.
2 350 " Hawkeye, comp.
1 350 " National, self-oiler, compound.
1 350 " Edison, 20 K.W., self-oiler.
1 350 " Western Electric.
1 360 " Duplex Multipolar, self-oiler.
4 540 " Edison, 30 K.W., s. o., compound.
1 540 " Siemens & Halske, M.P.
1 600 " Eickmeyer.
1 700 " Siemens & Halske, M.P.
2 700 " Westinghouse, M.P.
4 800 " Edison, 45 K.W., self-oilers.
1 1350 " Waddell-Enz, 80 K.W., M.P., for direct connection.

220-VOLT GENERATORS.

1 8½ K.W. Westinghouse, M. P., s. o.
1 9 " Lundell, self-oiler.
1 10 " Lundell, s. o., M.P., s. s.
1 12 " Edison, self-oiler.
1 15 " Edison, compound, s. o.
1 25 " Edison, self-oiler.
1 50 " Westinghouse, s. o., compound, horizontal type.

500-VOLT GENERATORS.

2 15 K.W. Edison, self-oilers.
1 15 " T.-H., self oiler.

1 25 K.W. T.-H., s. o., D25, compound.
1 25 " Edison, self-oiler.
1 35 " Mather, self-oiler.
2 45 " Edison, compound, self-oilers.
1 75 " Westinghouse, M.P., self-oiler.
1 75 " Westinghouse, Kodak set.

DIRECT-CONNECTED ALTERNATING GENERATORS.

1 350-light T.-H., A18, 15,000 alt, 1100 v., comp. wound, with exciter.
2 600-light T.-H., A6, 30 K.W.
1 600 " T.-H., 30 K.W., 2-phase.
1 600 " Gen. Elec., A30, slotted arm't.
2 650 " T.-H., A35, self-oilers.
2 750 " Westinghouse, self-oilers.
1 1000 " Wood, 50 K.W., self-oiler.
1 1200 " Westinghouse, 60 K.W., s. o.
2 1200 " G. E., A60, 1100 or 2200 volts.
3 1300 " T.-H., A70.
1 1500 " Wood, 75 K.W.
1 2000 " T.-H., 100 K.W.
1 4000 " Wood, 200 K.W.

ARC DYNAMOS.

1 20-light 2000 C.P. Western Electric.
1 30 " 2000 " Brush, No. 7.
2 35 " 2000 " T.-H., LD2.
1 40 " 2000 " West. Electric, s. o.
1 45 " 1200 " T.-H., M12, ball arm.
2 45 " 1200 " Brush, No. 7.
1 50 " 1200 " T.H., LD12, ball armature.
1 50 " 2000 " T.-H., MD2, ring armature.
1 50 " 2000 " Brush, No. 7½.
2 60 " 2000 " West. Electric, s. o.
1 60 " 2000 " Westinghouse.
2 60 " 2000 " Wood, No. 8.
1 65 " 2000 " Brush, No. 8, new arm't, extra fine.
2 75 " 1200 " Wood.
2 75 " 1200 " Standard.
2 75 " 1200 " Standard, s. o., air-insulated commutator.
2 75 " 2000 " Westinghouse, s. o.
3 125 " 1200 " Excelsior, latest type, s. o., fine.

110-VOLT MOTORS.

1 ¼ H.P. Sprague, series wound.
1 ¼ " Elbridge, shunt.
1 ½ " Elbridge, self-oiler.
1 ½ " Keller, self-oiler.
1 1 " Roth, self-oiler.
1 1 " Sprague, self-oiler.
1 1 " Hartley, M. P., self-oiler.
1 1 " H. P. Edison, self-oiler.
1 2 " Edison, 1½ K.W., self-oiler.
1 3 " Hawkeye.
1 3 " Westinghouse.
1 3 " Jenney, self-oiler.
1 3 " Nowotny, self-oiler.
1 3 " Mather.
1 3 " Card, self-oiler.
1 3 " C. & C., self-oiler.
1 5 " Crocker-Wheeler.
2 7½ " Westinghouse, self-oilers.
1 7½ " J. & C., self-oiler.
1 8 " Crocker-Wheeler, self-oiler.
1 10 " Edison, 8½ K.W., self-oiler.
2 12 " Siemens & Halske, M.P.
1 15 " Western Electric, self-oiler.
2 15 " Edison, 12 K.W., self-oilers.
1 18 " Westinghouse.
1 18 " Eddy, self-oiler.
1 18 " Commercial, self-oiler.
1 18 " Northern, M. P., self-oiler.
2 20 " Westinghouse, M.P.
1 20 H.P. Jenney, self-oiler.
1 20 " Columbian, M.P.
1 24 " Eddy, self-oiler.
2 25 " Hawkeye.
2 25 " Edison, 20 K.W., self-oilers.
1 25 " Duplex, M.P., self-oiler.
1 25 " National, self-oiler.
1 25 " Western Electric, self-oiler.
6 35 " Edison, 30 K.W., self-oilers.
1 35 " Siemens & Halske, M.P.
1 40 " Eickmeyer.
1 50 " Siemens & Halske, M.P.
2 50 " Westinghouse, M.P.
4 60 " Edison, 45 K.W., self-oilers.

220-VOLT MOTORS.

1 ¼ H.P. Lundell.
1 1 " Jenney, self-oiler.
1 1 " Sprague, self-oiler.
1 1 " E. & C., self-oiler, M.P.
1 2 " Belding.
1 2 " Thomson-Houston.
1 2 " Lundell, self-oiler, slow speed.
1 2½ " Holtzer-Cabot, self-oiler.
3 3 " Sprague, self-oilers.
1 3 " Kester, self-oiler.
1 3 " Crocker-Wheeler, self-oiler.
1 3 " Gen. Elec., type I.B., s. o.
1 3 " T.-H.
1 3 " C. & C., self-oiler.
2 3 " Card, slow speed, self-oilers.
1 5 " Eddy, ring type, self-oiler.
1 5 " Westinghouse, self-oiler.
2 5 " Westinghouse, s. o., M.P.
1 7½ " Eddy, self-oiler.
2 7½ " Edison, 6 K.W., self-oilers.
1 10 " Eddy, s. o., new armature.
1 10 " Eickmeyer, elevator motor.
1 10 " Lundell, self-oiler.
1 10 " Westinghouse, M.P., s. o.
1 12 " Lundell, 10 K.W., M.P.
1 15 " Eddy, self-oiler, new arm't.
1 15 " Edison, self-oiler, 12 K.W.
1 15 " Mather, ring type, new arm't.
1 18 " Edison, self-oiler, 15 K.W.
1 30 " Edison, self-oiler, 25 K.W.
1 50 " Northern, M.P., s. o., new
1 60 " Westinghouse, self-oiler, horizontal type.

500-VOLT MOTORS.

1 ¼ H.P. Detroit, series wound.
1 1 " Detroit.
1 1 " Holtzer-Cabot, self-oiler.
1 1 " Jenney, self-oiler.
1 1 " Crocker-Wheeler, self-oiler.
1 1 " Lundell, s. o., s. s.
1 1 H.P. C. & C., self-oiler.
1 2½ " Holtzer-Cabot, self-oiler.
1 3 " Toledo, self-oiler.
1 3 " Hobart, self-oiler.

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One 5 H.P. Ft. Wayne, single-phase, 100 volts.
One 10 H.P. Westinghouse, type C, 200 volts.
One 15 H.P., type C, Westinghouse, 200 volts.
One 10 H.P. General Electric, 3-phase, 220 volts.
One 25 H.P. Westinghouse, type C, 200 volts.
One 50 H.P. Stanley, 500 volts.
One 20 H.P. Stanley, 500 volts.

110-VOLT DYNAMOS.

One 5 K.W. Eddy, direct connected to Case engine.
One 25 K.W. Eddy, direct connected to Russel engine.
Two 12 K.W. Edison bi-polar.
Four 15 K.W. Edison bi-polar.
Four 20 K.W. Edison bi-polar.
Three 25 K.W. Edison bi-polar.
Four 30 K.W. Edison bi-polar.
Two 45 K.W. Edison bi-polar.
One 60 K.W. Edison bi-polar.
Two 100 K.W. Edison bi-polar.
One 150 K.W. Link Belt.

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One 10 x 12 Russell Automatic.
One 14 x 18 Russell Automatic.
One 10 x 12 Armington & Sims.
One 12 x 12 Armington & Sims.
One 13 x 12 Armington & Sims.
One 75 H.P. Westinghouse, Jr.
Three 60 H.P. Westinghouse Standard.
One 250 H. P. Westinghouse compound.
One 175 H.P. Dick & Church.
One 250 H.P. Lake Erie Engineering Co.
One 300 H.P. Dick & Church.

500-VOLT GENERATORS AND MOTORS.

Two 100 K.W. Edison bi-polar.
One 150 K.W. Walker.
One 250 K.W. Walker.
One 500 K.W. G. E., direct connected.
One 45 K.W. Ft. Wayne, Wood.
One 30 K.W., H.I., T.-H.
One 50 K.W. Western Electric.
Two 75 K.W., M.P. T.-H.
Two D-62 T.-H.
Two M.P., 90, T.-H.
One D-40 T.-H.

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1— 100-light Daft.
1— 250-light U. S.
1— 350-light Davis.
1— 800-light G. E.
1—1800-light Fort Wayne, 6-pole.

ARC DYNAMOS.

1 Brush,	1 light,	3000-cp.
1 Brush,	3 light,	2000-cp.
2 American Wood,	20 lights,	2000-cp.
1 Western Electric,	30 lights,	2000-cp.
1 T.-H., L. D.-2,	35 lights,	2000-cp.
1 Wood No. 6,	35 lights,	1200-cp.

GENERATORS.

1 U. S., 15-kw, 110 volts.
1 Davis, 22-kw, s. o., 110 volts.
1 Ft. Wayne, 6-pole, 100-kw, 110 volts, new.
1 Edison, 12-kw, s. o., 220 volts. compound,
1 Wood B. P., 45-kw, s. o., 500 volts.
1 T.-H., M.P.—75, 75-kw, s. o., 500 volts.
1 Edison No. 32, 100-kw, s. o., 500 volts.

ALTERNATING GENERATORS.

1—3A Slattery, 1300 lights, 16,000 alternations, 1100 or 2200 volts, s. o., with exciter.
1—A60 G. E., 1200 lights, 15,000 alternations, 1100 or 2200 volts, s. o., with exciter.

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¼-hp Elbridge, s. o.
1-hp Sprague.
1-hp Card.
3-hp Nowotny.
10-hp Daft.
20-hp U. S.
28-hp Queen City, s. o.

MOTORS—220 VOLTS.

1-hp Nowotny.
5-hp Davis.
10-hp E. R. & C. C., s. o.
10-hp Daft, 800 r. p. m.
15-hp Edison, s. o.

MOTORS—500 VOLTS.

20-hp Davis, s. o.
25-hp Brush, 350 r. p. m.
60-hp Wood, B. P., s. o.
90-hp T.-H., M.P., s. o.
120-hp Edison, B. P., s. o.

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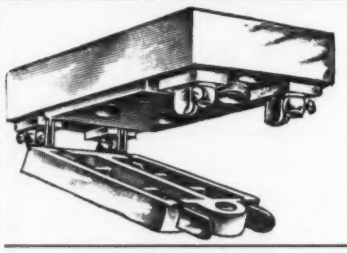

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ELECTRICAL WORLD AND ENGINEER, Publishers

120 Liberty Street, New York

Supplement to Electrical World and Engineer, November 3, 1900

TELEPHONE DEVELOPMENT NEWS

ALABAMA.

MARION, ALA.—The Marion Telephone Company has a switchboard capacity of 50 drops and the same number of subscribers. The increase has been steady, and country lines are contemplated. The manager is I. J. Davis.

ARKANSAS.

BOONSBORO, ARK.—The Boonsboro & Stillwell Telephone Company contemplates a continuance of its line to Stillwell. Mr. Carroll reports business fair and improvements being made.

CONWAY, ARK.—Mr. L. H. Pyle, manager of the Conway Telephone Company, informs us that their number of drops is 100, with 75 subscribers, 25 of whom are of recent date. The prospects of the company are favorable.

PINE BLUFF, ARK.—We are informed by Mr. C. E. Heron, secretary of the Pine Bluff Telephone Company, that it is about to install capacity for 100 more subscribers, in addition to the present 415 drops. It has 506 subscribers and an increasing list.

LITTLE ROCK, ARK.—The American District Telegraph Company of Arkansas has been incorporated. The capital stock is $10,000. T. P. Cook, E. C. Newton, H. D. Bennett, C. J. Frankel and N. M. Rose are the incorporators. Mr. Bennett is president.

COLORADO.

DENVER, COLO.—The Mountain Telegraph Company has been incorporated with a capitalization of $1,000,000. The incorporators are John L. Jerome, B. A. Chappel and J. A. Kebler.

FLORENCE, COLO.—The Colorado Telephone Company has for some time had men at work rebuilding the line between here and Pueblo. New poles have been planted, with ten-pin cross-arms. New wires have also been strung and a through metallic circuit has been lined up between here and Denver. This gives better service on long-distance talk. The men are now building through this town, after which five circuit wires will be strung between here and Canon City.

CONNECTICUT.

ANSONIA, CONN.—The Ansonia Telephone Company has a 200-drop capacity, but uses only 110. There are 330 subscribers, and there was a 20 per cent advance last year, with probably the same next. The manager, Mr. C. D. Warner, reports a satisfactory outlook.

DELAWARE.

BETHEL, DEL.—The Bethel, Laurel & Sharpton Telephone Company has been sold to the Diamond State Telephone Company, of Dover, Del.

WILMINGTON, DEL.—The president of the Delmarvia Telephone Company informs us that it has extended its lines to Newport, Del., and projects lines to Newark, Del.

FLORIDA.

PALATKA, FLA.—The Palatka Telephone Company, with a switchboard capacity of 200 drops, has 151 subscribers.

GEORGIA.

THOMASTON, GA.—Mr. R. A. Pincher writes of steady growth, there being 106 subscribers. His switchboard capacity is 100 drops.

EASTMAN, GA.—The Eastman Telephone Exchange is in good condition, with a 100-drop board and 80 subscribers. Increased lines and business are projected.

CARROLLTON, GA.—James T. Anderson, James N. Cox and Lewis K. Smith have incorporated the Gainesboro Telephone Company. Capital stock $4000 with privilege of increasing to $40,000.

MILLEDGEVILLE, GA.—The Milledgeville Telephone Company will have connections with Eatonton, Monticello and Jackson this month. It has switchboard capacity of 220 drops and 135 subscribers, of whom 15 have joined recently.

CUTHBERT, GA.—Mr. S. B. Hudson, proprietor of the telephone business, informs us that his switchboard has a 100-drop capacity, that he has 80 subscribers and that he contemplates rebuilding his exchange. Business is promising.

AUGUSTA, GA.—The Augusta Telephone & Electric Company has an 800-drop capacity and 535 subscribers. Mr. Lee Campbell, the manager, informs us that, with contemplated toll lines, the number will probably be very largely increased.

DALTON, GA.—The Dalton Telephone Company has recently extended its lines to near-by towns and will increase its long-distance connections. It now has nearly 200 subscribers, and the outlook for the future is very good. It is the company's purpose to bring the entire northern part of the State together by telephonic connections.

ILLINOIS.

NOHLAND, ILL.—Messrs. Beggs, Glenn & Reaich operate a 100-drop switchboard and have 40 subscribers.

VIRDEN, ILL.—Messrs. Snecker Bros. report good business and a fair outlook. They have 100 subscribers.

AVON ILL.—Mr. James Carr informs us that his company his 30 miles of ground circuit toll line, connecting six towns.

HOOP POLE, ILL.—Mr. Geo. Mathis informs us that he has about 100 subscribers and contemplates improving the system.

JERSEYVILLE, ILL.—The Jerseyville Telephone Company has a 200-drop board and 203 subscribers, with probable increase.

ATLANTA, ILL.—The Atlanta Telephone Company keeps up a steady advance. It has 210-drop capacity and 192 subscribers.

ASSUMPTION, ILL.—The Assumption Telephone Company has a 100-drop switchboard, 78 subscribers and a promising outlook.

MT. PALATINE, ILL.—Mr. J. C. McNabb, of the Mt. Palatine Telephone Company, informs us that business is fair. It has 100 subscribers.

STAMFORD, ILL.—Mr. Patch, of the Patch Telephone Company, reports a fair outlook. With a 100-drop board it has 100 subscribers and an expected increase.

MARSEILLES, ILL.—The Marseilles Telephone Company is operating an exchange here with a capacity of 110 drops. It has 104 subscribers. Mr. W. H. Spicer is secretary.

CHESTER, ILL.—Mr. A. G. Gordon, of the Gordon Telephone Company, reports extending a toll line to connecting systems. With a 200-drop board it has 170 subscribers.

FAIRFIELD, ILL.—The Wayne County Telephone Company is building toll lines. It now has 150 subscribers and a satisfactory outlook for business. Mr. C. M. Broch is manager.

BETHANY, ILL.—Mr. W. S. Herman favors us with the following: Switchboard capacity, 100 drops; subscribers, 53. Prospects very good. Building of country and toll lines projected.

MATTOON, ILL.—Mr. Gay, secretary of the Mattoon Telephone Company, reports business excellent and a proposed 100-board extension. It has at present a 500-drop board and 494 subscribers.

DEER CREEK, ILL.—Messrs. Davis & Son inform us that business and prospects are good. They intend putting in a 100-drop switchboard to accommodate 70 subscribers, and more are expected.

CRADWICK POSTOFFICE, ILL.—Mr. F. Zinnel informs us that the Carroll County Telephone Company has a switchboard capacity of from 50 to 300, and 100 subscribers. An increase is projected.

CARLINVILLE, ILL.—The Macoupin Telephone & Telegraph Company has a splendid outlook. Mr. Fletcher informs us that it has a 200-drop board and 142 subscribers. Both system and work are of the best.

CHAMPAIGN-URBANA, ILL.—The Home Telephone Company, represented by Manager Lee, reports the outlook the best in the world. It has 100-drop-board capacity and 550 subscribers, besides having 150 contracts to fill.

MONTICELLO, ILL.—Mr. W. F. Lodge informs us that he projects some farmers' lines and that the outlook is good. He operates a 200-drop board and has a steady growth of ten telephones per month. He has 197 subscribers.

ROSSVILLE, ILL.—We learn from Mr. Warner, of the Rossville Telephone Company, that its lines run to and through about a dozen towns and villages. It has 250 subscribers and a steady growth, the outlook promising most favorably.

METROPOLIS, ILL.—The Metropolis Telephone Company, through Mr. Smith, manager, informs us of a prosperous season and bright prospects. Its switchboard is of 200-drop capacity and there are 105 subscribers. One hundred per cent increase is expected.

GOLCONDA, ILL.—Mr. Walker, president of the Pope County Telephone Company, reports as follows: Switchboard capacity, 100 drops, and 140 subscribers on exchange and toll lines. Recent increase is at the rate of 50 per cent, and prospects are very bright.

ANNA, ILL.—The Southern Union Telephone Company has 1150 subscribers in exchanges at Carlisle, Trenton, Cobden, Jonesboro, Campbell Hill, Nashville, Breese, Anna and Dongola, all in Illinois. Mr. Edwin A. Knapp is superintendent. He reports the business outlook as very favorable.

CHATSWORTH, ILL.—The Peoria & Eastern Telephone Company has gained 250 subscribers in ten months and is now building 60 miles of toll line. It expects to put in two exchanges with 250 subscribers. At present the number is 500, with 700-drop-board accommodation. We are indebted for the above to the manager, Mr. F. C. Stanford.

MARENGO, ILL.—The McKenny County Telephone Company has had a steady growth since it began business in February, 1897, with 39 subscribers. It

now has 148 subscribers and will soon increase its switchboard capacity, the limits of the present board having been reached. Mr. N. V. Wolehen is treasurer. He reports a fine business outlook.

OAKLAND, ILL.—The Oakland Telephone Company operates exchanges at Oakland, Isobel and Brocton, with boards of 200, 100 and 100-drop capacity, respectively. There are about 270 subscribers, about half of which were secured during the year. President W. S. Ashmore reports that extensions will be made *ad lib.*, and that the outlook for business is flattering.

FARMER CITY, ILL.—Mr. B. F. Wasson, superintendent of the Farm & City Telephone Company, furnishes an interesting account of a successful enterprise. Switchboard capacity is 200 drops, with the same number of subscribers. About 400 miles of lines and 100 under construction. All new lines are metallic circuit, and four counties are now connected.

INDIANA.

MELROSE, IND.—The Merchants' Telephone Company has built several miles of line, but has no exchange.

SYRACUSE, IND.—The Syracuse Telephone Company reports a fine outlook. It operates a 100-drop board and has 94 subscribers.

SMITHLAND, IND.—The Smithland Telephone Company has a 75-drop board and 55 subscribers. Mr. G. K. Smith is secretary.

RIDGEVILLE, IND.—The Ridgeville Telephone Company has just commenced operations with 50 subscribers and a 50-drop board.

GREENSBURG, IND.—The Greensburg Telephone Company reports good prospects. It operates a 300-drop board and has 240 subscribers.

STEUBEN, IND.—The Steuben County Electric Telephone Company has a switchboard capacity of 210 drops, 150 subscribers and a projected increase.

SHERIDAN, IND.—The Central Indiana Telephone Company has a 200-drop-board capacity and 10 long-distance lines, with 30 miles more projected. It has 173 subscribers.

CHERUBUSCO, IND.—The Cherubusco Telephone Company has been in operation only two months, but reports business good, with 70 subscribers and 100-drop-board capacity.

GEORGETOWN, IND.—The South Vermilion Telephone Company proposes doubling its capacity, which is already 600 drops. It has 420 subscribers, more than half of recent date.

ROANOKE, IND.—There is no regular exchange in this town, the only telephone connection being two toll stations of the Bell and National Telephone Company, of Ft. Wayne, Ind.

VAN BUREN, IND.—The Van Buren Telephone Company informs us, through Mr. John Saxon, that prospects are bright. Its present capacity is a 100-drop switchboard, with 58 subscribers.

CONNERSVILLE, IND.—Mr. Frazer, secretary of the Connersville Telephone Company, informs us that it has switchboard capacity of 300 drops and 276 subscribers. Growth is steady and outlook favorable.

DARLINGTON, IND.—The Darlington Telephone Company has a growing exchange and the business outlook, as reported by Treasurer James A. Peterson, is good. This company one year ago had 90 subscribers; now it has 170.

HARTFORD CITY, IND.—The Indiana Telephone Company has a 300-drop capacity in Hartford City and 200 in Montpelier. There are 425 subscribers. A small exchange is being installed at Upland, starting with 35 subscribers.

BROOKVILLE, IND.—The Brookville Telephone Company, through Mr. Baughman, secretary, has been employed in rebuilding its plant. The outlook, however, is good, and with a switchboard capacity of 110, it has 100 subscribers.

MADISON, IND.—The Madison Telephone Company will extend its exchange and is waiting for a new switchboard of 300 drops. It now has 250 subscribers, and the business outlook is reported by Treasurer E. A. Marks as very good.

MICHIGAN CITY, IND.—The Merchants' Mutual Telephone Company has a 600-drop switchboard and 515 subscribers, 125 of whom have been gained during the year. It proposes to have a full capacity within six months. Mr. Van Druse is the secretary.

PENDLETON, IND.—The Pendleton Telephone Company is thriving, having put in 120 telephones within a year. Its switchboard capacity is 150 drops; it has 150 subscribers, and a fine metallic system, with lines to Anderson, Emporia and other places.

CLINTON, IND.—Mr. J. S. Hooney, proprietor of the Home Telephone Exchange, writes of a very bright outlook, and figures prove a prosperous present, there having been a gain of 64 subscribers during the past year. It now numbers 197, with a 200-drop board.

RUSHVILLE, IND.—Mr. W. M. Frazer, secretary of the Rushville Co-Operative Telephone Company, informs us that with a switchboard capacity of 300 drops it has 246 subscribers, not including country lines.. An increase of 50 to 100 new telephones is contemplated.

INDIANAPOLIS, IND.—The New Telephone Company has a switchboard capacity of 4000 drops, with branch exchanges of 500. It numbers 3700 subscribers, 1700 of whom joined from July, 1899, to July, 1900. Large extensions are proposed to meet increasing demands.

TERRE HAUTE, IND.—The manager of the Citizens' Telephone Company, Mr. Henry A. Coit, informs us of the growing prosperity of his company. Its switchboard capacity is 3000 drops, and it has 1200 subscribers. Improvements are under way and a large increase is projected.

ROCKVILLE, IND.—The manager of the Parke County Telephone Company informs us that it has in its main office 200-drop capacity; Montezuma exchange, 100; Rosedale, 100; Bellmore, 100; Bridgeton, 12. It has 300 subscribers, has been building rapidly and during ten months has gained 150 new subscribers.

NORTH VERNON, IND.—The North Vernon & Vernon Telephone Company and the Jennings County Telephone Company are owned and operated by the same management. The former is the city company and the latter the toll line company. The system has a switchboard capacity of 300 drops, and 305 subscribers, including several on party lines. During the past summer 75 subscribers have been added. Extensions will be made next spring. Mr. W. G. Kendrick, superintendent and manager, reports that the business outlook for the company is better than ever before.

INDIAN TERRITORY.

SOUTH McALESTER, IND. TER.—The South McAlester Telephone Company informs us, through Manager Roberts, that its drop-board capacity is 200. Eufala exchange, 35; Canadian, 12; Hartshorn, 12; Wilburton, 10. It has 275 subscribers, has recently completed 105 miles to Ft. Smith, Ark., and contemplates an extension of its present lines, which touch over 30 places.

IOWA.

CLEAR LAKE, IA.—The outlook of the Clear Lake Independent Telephone Company is very good. It operates a 200-drop board and has 70 subscribers.

GALVA, IA.—The Galva Telephone Exchange Company informs us, through its secretary, Mr. Walters, that prospects are fair. There are 50 subscribers and 50-drop board capacity.

SIGOURNEY, IA.—The People's Telephone Company, Mr. Dobie, manager, is flourishing. With drop-board capacity of 150, it has 140 subscribers and will soon establish toll lines.

DES MOINES, IA.—The Audubon County Telephone Company, of Audubon, has been incorporated. Capital, $25,000. Incorporators: F. P. Hocker and W. B. Swaney, both of Audubon.

BOONE, IA.—Mr. C. Deering, secretary of the Boone County Telephone Company, writes that with a 600-drop board it has 515 subscribers and intends putting in an exchange at Ames, Ia.

FORT DODGE, IA.—The Fort Dodge Telephone Company anticipates a great addition to its 635 subscribers. Its capacity is 700 drops. Mr. Caister is manager, and says business could not be better.

HEDRICK, IA.—President A. J. T. Brooks, of the Hedrick Telephone Company, has just started business and finds it more successful than he anticipated. With a 100-drop board there are 60 subscribers.

CLINTON, IA.—We are indebted to the Tri-City Company for an account of the Maquoketa Telephone Company, which opens business Nov. 1 with a 200-drop board, 175 subscribers and a bright future.

PLEASANTON, IA.—The Davis City & Pleasanton Telephone Company has a switchboard capacity of 30 drops, with 30 subscribers and an expected increase. Prospects are bright. Secretary, J. N. Painter.

GARNER, IA.—Mr. Abbey, secretary of the Garner Electric Light, Power & Telephone Company, informs us that business is increasing and the outlook is promising. It has a 100-drop board and 75 subscribers.

MONROE, IA.—The Monroe Telephone Company has grown from 85 subscribers in 1895 to 200 at the present time. It uses the apparatus of the American Electric Telephone Company. Wm. B. Reily is president.

CEDAR RAPIDS, IA.—The Cedar Rapids & Marion Telephone Company has a 1000-drop switchboard and 910 subscribers, 100 of whom have recently been gained. Mr. Durin, the secretary, reports a flourishing business.

IOWA CITY, IA.—The Johnson County Telephone Company began business May 1, 1900, and now has 529 subscribers, which nearly reaches the limit of its board—600 drops. It contemplates building 90 miles of toll lines.

IOWA FALLS, IA.—The Hawkeye Telephone Company began business on July 1 and now has 565 subscribers. It will increase its subscribers by 137 more, and its business outlook is good. The capacity of its board is 650 lines.

MARSHALLTOWN, IA.—The Marshall Telephone Company has a switchboard capacity of 1000, but uses 600 drops, for 600 subscribers. It contemplates putting its wires under ground. Business for the future seems promising.

OTTUMWA, IA.—The Ottumwa Telephone Company informs us, through its manager, Mr. H. E. Pancost, of the prosperity of the business. Switchboard capacity, 1100 drops; number of subscribers, 1000, with large projected increase.

INDEPENDENCE, IA.—The Buchanan County Telephone Company, of Independence, has been incorporated. Capital, $50,000. Incorporators: W. F. Roney, M. W. Harmon, J. F. Van Voss, C. E. Ransier and C. F. Bennett, all of Independence.

TABOR, IA.—Mr. A. A. Failing, of the City Telephone Company, reports that it operates exchanges in Sidney, Randolph, Malvern and Tabor, with 50-drop boards at each, and about 200 subscribers. Numerous extensions are in contemplation.

INDIANOLA, IA.—The Indianola Mutual Telephone Company reports an encouraging outlook there. It now has 185 subscribers, a recent increase of 85. It has a switchboard capacity of 200 drops. Seventy miles of toll line have been added to the system.

DES MOINES, IA.—Mr. O. H. Gray, of the Mutual Telephone Company, favors us with the following: Switchboard capacity is 1600, with 1700 subscribers; the rate of growth is 25 per month. It is adding a cable and figuring on an underground system.

WEST LIBERTY, IA.—The West Liberty Telephone Company intends to build a toll line connection to Nichols, Muscatine, Iowa City and other points. It now has a 100-drop board and 90 subscribers. It commenced business on Aug. 8 last. Mr. H. N. Macdonald is manager.

MT. VERNON, IA.—Mr. Gormly, the secretary of the Mt. Vernon Telephone Company, is sanguine that the future will be very successful. With switchboard capacity of 200 drops, 135 are in use, and they have 133 subscribers, and an expected increase of 10 per cent.

OSKALOOSA, IA.—The Home Telephone Company is an energetic and successful concern. It now has 552 subscribers, an increase of 100 during the past twelve months, and expects to increase the present number by a like amount during the coming year. Its switchboard capacity is 560 lines. Business is brisk with this company. Mr. W. H. Kalbach is president.

FAIRFIELD, IA.—President H. C. Raney, of the Jefferson County Telephone Company, reports a growth of 50 subscribers since Jan. 1 last. The company

has 254 subscribers and a 300-drop Eureka switchboard. It expects to occupy a new office soon. During the year this system was connected with that of the Eldon Telephone Company. The company's business is growing all the time and the outlook is satisfactory.

KANSAS.

SABATHA, KAN.—The Sabatha Telephone Company has a 200-drop board and 140 subscribers.

CLAY CENTRE, KAN.—The Clay Centre Telephone Company has a 300-drop board, with 255 in use, and the same number of subscribers.

LINCOLN, KAN.—The Lincoln telephone exchange has enjoyed a steady growth this year, now having 99 subscribers. Meek & Herman are the proprietors.

WATERVILLE, KAN.—The Waterville Telephone Company commenced operations but a few months since with fair prospects. Its drop-board capacity is 100, and it has 40 subscribers.

DODGE CITY, KAN.—We are informed by Mr. G. T. Martin, manager of the Dodge City telephone exchange, that it has 70 subscribers and the number is gradually increasing. It has a 100-drop board.

LARNED, KAN.—The Larned Telephone Company uses the automatic system, and commenced operations July 1 with 35 subscribers, which number is now increased to 50. Alex. A. Sharp is secretary.

LEAVENWORTH, KAN.—Mr. H. W. Koohler states that the prospects of the People's Telephone Company are good. It operates a 700-drop switchboard, with prospective increase, and has 685 subscribers, 75 of whom have been gained recently.

CEDARVALE, KAN.—Mr. J. M. Dasbaugh sends us the following: Switchboard capacity is: Cedarvale, 100; Sedan, 100; number of subscribers, 68 and 75. A toll line will be built to connect the two exchanges this fall. Prospects are very good.

ELLSWORTH, KAN.—The local telephone is in the hands of the Ellsworth Electric Light Company. It has a switchboard capacity of 100, and 98 subscribers, with recent growth of 15. Another switchboard and 40 miles of toll line are projected. The manager is C. F. Pohlman.

ABILENE, KAN.—The Brown Telephone Company began business on Feb. 1 of this year with 175 subscribers. It has a board capacity of 200 lines. The company is now building 50 miles of copper toll line. The prospects are that it will increase its capacity by 100 more instruments within the year.

GALENA, KAN.—Mr. M. L. Robinson, manager of the Galena Telephone Company, reports a 400-drop board quite insufficient with the increased sphere of operations. It projects a larger one and a centralized battery system. It has 350 subscribers, and exchanges at Columbus and Weir City, with 200 and 175 more, respectively.

MANHATTAN, KAN.—The Wareham & Wood Telephone Company, of Manhattan, and the Wareham & Dewey Telephone Company, of Junction City, report with 400 and 200-drop boards, respectively, and 350 and 200 subscribers. The plant is new and business and prospects good. We are indebted to Mr. H. P. Wareham for this information.

KENTUCKY.

HICKMAN, KY.—Mr. H. N. Cowgill writes that prospects are good; he has switchboard capacity of 100 drops and 85 subscribers.

HALEY'S MILL, KY.—The Haley's Mill Telephone Company, Mr. H. C. Helsley, secretary, has 30 miles of toll line, 10 subscribers.

AUGUSTA, KY.—The Augusta Telephone Company has a switchboard capacity of 60 drops and 58 subscribers. Business prospects are good.

LEBANON, KY.—The Lebanon, Louisville & Lexington Telephone Company has a 135-drop switchboard capacity, which will be increased to 200. There are 135 subscribers.

CLINTON, KY.—The Clinton Telephone Company, whose lines extend over a large area, reports business excellent and a bright outlook. It has a 100-drop board and 104 subscribers.

CATLETTSBURG, KY.—Mr. Meek, of the People's Telephone Company, informs us that it contemplates enlarging its business, the outlook being very favorable. It has a 215-drop board and 179 subscribers. During 1900, 54 new telephones have been put in.

FRANKFORT, KY.—Mr. W. H. Longmore, secretary of the Frankfort Telephone Company, informs us that it has been in operation only one year and finds business flourishing. Its drop-board is of 300 capacity, subscribers 263, and it proposes considerable toll line and country work.

FULTON, KY.—We are indebted to Mr. R. M. Chewning, treasurer of the West Kentucky Telephone Company, for the following: The company has 12 exchanges and 50 miles of copper metallic toll line; switchboard capacity, 400; number of subscribers, 350. It is now stringing 4000 ft. of 100-pair cable.

HENDERSON, KY.—The Hendersonville Telephone & Telegraph Company is managed by Mr. J. W. Walker, who also looks after two or three other exchanges in Union County, with about 600 subscribers. The Henderson Exchange has a board capacity of 500 and 535 subscribers. Projected work is in the direction of toll lines, and the business outlook for this company is reported as good.

LOUISIANA.

ROLFE, LA.—We are informed by Mr. C. E. Fraser, of the Rolfe Telephone Company, that it commenced business July 1 with 75 subscribers, which number has increased to 113. It has a 150-drop board, and projects farm lines with other local business.

ALEXANDRIA, LA.—The Alexandria Telephone Company sends an interesting account of progress, due in a great measure to its enterprising manager, Mr. Ross. Commencing as a private enterprise, it is now one of the strongest corporations in the State, with 200 subscribers and a steady growth of about 50 telephones per annum. Their present drop capacity is 200, and a large increase is expected.

MAINE.

NORRIDGEWOCK, MAINE.—The new Sharon & Norridgewock Telephone Company commences with a fair outlook. There are but 25 subscribers now, and a small switchboard capacity.

MARYLAND.

NEVADA, MD.—The Nevada Telephone Company reports a good outlook. Its switchboard capacity is 330, its subscribers 323, with expected increase.

SNOW HILL, MD.—The Worcester Telephone Company has 64 town subscribers, with a 100-drop switchboard. It has recently built 22 miles of toll line, with 10 subscribers.

BERLIN, MD.—The Synepuxent Telephone Company has a switchboard capacity of 50 drops. It commenced business July 10 with 15 subscribers, which have been increased to 45.

WESTMINSTER, MD.—The Western Maryland Telephone Company, of Carroll County, has a 100-drop board in its its exchange, and 200 subscribers. Extension of its lines to Baltimore are projected.

HAGERSTOWN, MD.—The Hagerstown Telephone Company is keeping up an increasing reputation. It has a 100-drop metallic switchboard, but prospects indicate a larger plant. At present there are 62 subscribers. Two more toll and party lines are to be built.

MASSACHUSETTS.

HAVERHILL, MASS.—The People's Telephone Company of Massachusetts has 600 subscribers and 240-drop capacity. Mr. Spofford informs us that large amounts have been spent in extensions and improvements.

WORCESTER, MASS.—The management of the Citizens' Telephone & Telegraph Company claim it has already secured 1500 subscribers. This is about half the total number of the New England Telephone & Telegraph Company.

VINEYARD HAVEN, MASS.—The Public Telephone Company, whose lines extend over the five towns which constitute the Island of Martha's Vineyard, will make extensive improvements within the next six months. We are indebted to Mr. Lane, the owner and manager, for these notes. It operates a 100-drop board and has 91 subscribers.

BOSTON, MASS.—Owing to the rapid increase in the number of subscribers in the present Haymarket Telephone Exchange, the New England Telephone & Telegraph Company has found it necessary to divide the district, making two exchanges in place of one. On or about Jan. 1, 1901, a new exchange will be opened under the name of "Richmond."

AMHERST, MASS.—Mr. C. F. Branch, president of the late Amherst Telephone Company, which has closed up its business, writes as follows: "After a little it is probable that some new scheme may present itself by which we can arrange for local telephone service without being overburdened by excessive rates." The New England Telephone Company is doing all the Amherst business at present.

SHELBURNE FALLS, MASS.—We are informed by Mr. G. E. Davis, of the Heath Telephone Company, that its switchboard capacity is 50 drops, and the number of subscribers is about 200. It covers at present the following towns: Shelburne Falls, Coleraine, Heath, Charlemont, all in Massachusetts; Jacksonville and Sadawga, and will add in the near future Greenfield, Buckland and Ashfield, Mass.

MICHIGAN.

WATERLOO, MICH.—The Rural Telephone Company has 15-10 switchboard capacity. We learn from Mr. Gorton that it is a farmers' company and operates telephones on party lines. Its subscribers are its stockholders.

EVART, MICH.—Mr. C. E. Bell, proprietor of the Evart Telephone Exchange, reports a very promising outlook for business. His board capacity is 100 drops. He now has 60 subscribers and expects the number to exceed 100.

ST. LOUIS, MICH.—The Union Telephone Company has a board of 100-drop capacity and is about to put in another to accommodate waiting subscribers. The present number is 115, of whom 65 have joined within the past year.

ALPENA, MICH.—Mr. R. Foley, manager of the Alpena Mutual Benefit Telephone Company, reports a steady increase of subscribers. They now number 285, of which 80 are recent additions. The switchboard has a 300-drop capacity

WATERVLIET, MICH.—The Watervliet & Paw Paw Lake Telephone Company has been sold to the Twin City Company, of Benton Harbor. The switchboard capacity is 50 drops, and it has an equal number of subscribers, many recently added.

BENTON HARBOR, MICH.—The Twin City Telephone Company sends a good account of business, through Manager J. S. Moats. Switchboard capacity, 700, 200, 100, 50 drops; number of subscribers, 600, 187, 72, 41. About 25 per cent increase is proposed.

REED CITY, MICH.—The Reed City Telephone Exchange & Citizens' Telephone Company reports, through Mr. C. F. Marshall, its manager, that prospects are bright and subscribers steadily increasing in number. It has lately installed a fine new switchboard of 200-drop capacity.

BAY CITY, MICH.—Mr. R. F. Johnson, of the Valley Telephone Company, informs us that there has been steady growth since the formation of the company, in 1898. The present capacity is 2400 drops, and the number of subscribers is 2600. It operates in this city, Saginaw and Flint.

ATHENS, MICH.—The Citizens' Telephone Company expects to increase the number of subscribers by about 30 within 60 days, and will rebuild its lines. This system was recently purchased by the Citizens' Telephone Company, of Grand Rapids, Mich. Mr. Jacob Keene is manager at Athens.

GRAND RAPIDS, MICH.—Mr. J. B. Ware, the secretary of the Citizens' Telephone Company, favors us with a comprehensive description of its operations, which have increased greatly and promise to do still more in future. Its exchanges cover 21 cities and its subscribers' lists are proportionately large.

PARMA, MICH.—The North Parma Telephone Exchange Company uses bells and lever switch; as each section carries 18 or 20 telephones it cannot use the drop switch. There are 96 subscribers, and local mileage, which is now 50,

will be doubled. Mr. Hubert, the secretary, informs us that local business and connections with other lines is good.

LANSING, MICH.—The Citizens' Telephone Company has a 1000-drop board and 840 subscribers, with a steady increase of 125 per year. Mr. F. B. Johnson, the local manager, informs us the company is owned by the Citizens' Company, of Grand Rapids, J. B. Ward, secretary. It is now connecting up with entire new construction, employing the latest and best apparatus throughout.

HART, MICH.—The Oceana Telephone Company, with a switchboard capacity of 650 drops, has 530 subscribers, and projects two new toll lines. Present business and prospects are very bright. It has exchanges in Ludington, Walkerville, Shelby, Montague and other places, with connections to the finest farm sections of Oceana, Mason, Lake Newaygo and Northern Muskegon counties, and all the cities and towns in those counties.

CARO, MICH.—The Moore Telephone System, of which Mr. W. J. Moore, the proprietor, kindly favors us with notes, is one of the oldest and most prosperous independent telephone concerns. It has a dozen exchanges, with a total of 700 subscribers, and is now putting a new circuit between Caro and Saginaw. It operates 400 miles of toll line, and indications point to a still more prosperous future. Its main office in Caro is equipped with its own electric light, storage battery and steam-heating plants.

MASON, MICH.—The Mason Local Telephone Company's exchange has a board capacity of 70 drops, with 80 jacks. The business started last January with 45 subscribers. Five different companies are connected with the Mason system, and two other companies will soon be connected also. The latter two include the Independent U. S. Telephone Company, of Cleveland, which is stretching four lines from Saginaw to Toledo (first-class copper line). The Rural Telephone Company, which will soon connect with the Mason system, now has connections with about 200 farmers through this section of the country, and its system embraces ten or twelve towns and cities. The outlook is therefore very promising for a large increase of business, which will necessitate an increase of capacity of the Mason exchange.

MINNESOTA.

ADA, MINN.—The Norman County Telephone Company is building about 60 miles of line, which will soon be completed.

BRAINERD, MINN.—Mr. C. A. Walker furnishes favorable information. His switchboard capacity is 150 drops, with 195 subscribers and a good outlook.

WORTHINGTON, MINN.—Mr. C. J. Smallwood informs us that his telephone exchange has a 200-drop switchboard and 190 subscribers. Business grows steadily.

RUSHFORD, MINN.—The Phœnix Telephone Company has 100-drop boards at Rushford and Lanesboro, and about 100 subscribers. This is a new company.

WASECA, MINN.—The Waseca Telephone Company has 150 subscribers and the same number of switchboard drops, with 25 more to be added. The prospects are bright.

DETROIT CITY, MINN.—The Detroit Telephone Company reports recent growth of 25 per cent. It now has 100 subscribers, and switchboard capacity of 150 drops. Mr. T. Alston Nottage is president.

WINONA, MINN.—The Winona Telephone Company reports steady increase. It has a 620-drop board and 650 subscribers. It proposes an increase of a 100-drop section, new cable and some toll lines.

LITCHFIELD, MINN.—Mr. H. I. Peterson, treasurer of the Litchfield Telephone Exchange Company, informs us that its switchboard capacity is 150 drops and that an improved switchboard is to be put in. It has 125 subscribers.

CROOKSTON, MINN.—The manager of the Crookston Telephone Company, Mr. E. M. Walsh, is pleased with the increase in his company's business from 90 to 175 subscribers and further good prospects. It has a 200-drop board.

HUTCHINSON, MINN.—Mr. M. W. Clay, president of the Hutchinson Telephone Exchange Company, reports that the outlook is good, and, with a drop-board capacity of 150, it has 130 subscribers, of whom 50 recently joined. It has a 6-mile country line, and another of 12 miles is projected.

MANKATO, MINN.—Mr. C. K. Willard, manager of the Mankato Citizens' Telephone Company, sends an account of continued prosperity. Started less than two years ago, against Bell competition, with 200 subscribers, it now has 480, and a constant increase of numbers. Its switchboard capacity is 500 drops.

CHADFIELD, MINN.—Mr. G. R. Thompson, general manager of the People's Telephone Company, informs us that it has 725 subscribers, which number is constantly increasing. It owns and operates exchanges at Spring Valley, Chatfield, St. Charles and Stewartville, with rural lines into the adjacent country.

ST. PETER, MINN.—Mr. Jas. Bennett, proprietor of the St. Peter Telephone Company informs us that his company is very prosperous, the number of subscribers being 225, of whom 75 have been added during the last year, prospects for the succeeding one being equally favorable. The switchboard capacity is 210 drops.

RUSH CITY, MINN.—The Northeastern Telephone Company has exchanges at Rush City (50 drops), Mora (50 drops), Cambridge (50 drops), and Princeton (100 drops). It has 200 subscribers and operates 110 miles of long-distance lines, 10 miles having been recently built. Eighteen miles of line are projected and a 100-drop board is to be purchased for one of the exchanges. The company has branches to various towns, covering five counties in part with its system.

MISSISSIPPI.

BOONEVILLE, MISS.—The Cumberland Telephone & Telegraph Company has been granted franchise to establish an exchange here.

HOLLY SPRINGS, MISS.—Mr. E. S. Mosby, who owns a telephone exchange here, is extending lines from 10 to 15 miles into the country.

HANDSBORO, MISS.—J. H. O'Neill, J. G. Airey, J. F. Stewart and others have been granted a franchise for the construction of a telephone system.

ALBANY, MISS.—Mr. Shannon, of New Albany, Miss., is making arrangements to put in a telephone exchange here. He has already secured about 50 subscribers.

PONTOTOC, MISS.—C. W. Bolton, of Pontotoc, has recently purchased a 100-number switchboard and will install it in place of his 50-number board. He reports the telephone business as growing rapidly.

PITTSBORO, MISS.—The Blount Mineral-Well Telephone Company operates a line to Coffeeville, 25 miles distant, with five pay stations on the line. Mr. Gaines, secretary and treasurer, reports a favorable outlook.

OCEAN SPRINGS, MISS.—The Cumberland Telephone & Telegraph Company has not been long in existence, but makes a good showing and has good prospects. It has at present a 150-drop switchboard and 75 subscribers.

CORINTH, MISS.—Mr. McCallum, manager of the Cumberland Telephone & Telegraph Company, sends good accounts of the business. Its switchboard has a capacity of 300 drops, with 100 more contemplated. There are 200 subscribers, nearly half of recent addition.

GREENWOOD, MISS.—Mr. A. M. Gibson has purchased a one-half interest in the Greenwood telephone exchange from Geo. W. Schening. They expect to improve the plant by putting in an up-to-date 200-number switchboard and a number of desk telephone sets for the convenience of their customers.

COLUMBUS, MISS.—Mr. Hugh Campbell, manager of the Citizens' Long Distance Telephone & Telegraph Company, reports a steady increase of business in toll lines and telephones. The Columbus drop-board is 400, Aberdeen 200, with 500 subscribers. It intends rebuilding 150 miles of long-distance line.

STARKVILLE, MISS.—Mr. R. K. Wied, president of the Starkville Telephone & Power Company, informs us that its switchboard capacity is 100 drops, with 22 extra drops and jacks. The switchboard has been full for a year, and new subscribers have been put on party lines, but a new board will be bought soon. There are 155 subscribers and the outlook is good.

MISSOURI.

MONTGOMERY CITY, MO.—The Montgomery Telephone Company has 200-drop switchboard capacity and 85 subscribers.

PRINCETON, MO.—The Grand River Telephone Company has a fair outlook and projects further extensions. It has 301 subscribers.

FULTON, MO.—The manager of the Fulton Telephone Company informs us that prospects are very good. It has a 400-drop switchboard, 204 subscribers and a projected increase of 200 or 300.

JEFFERSON CITY, MO.—The Capital Telephone Company makes a fine showing. With a 400-drop board it has 330 subscribers and expects a large increase. Mr. E. R. Hogg is manager.

ST. LOUIS, MO.—The Queen City Telephone Company, of St. Louis, has been incorporated with a capital stock of $50,000. The incorporators are Charles G. Chaddock, Fred. A. Churchill, H. M. Dix and others.

LIBERTY, MO.—The Liberty Telephone Company informs us that the outlook is excellent. It has a switchboard capacity of 220 drops, 205 subscribers, and expects to put in at least five telephones every month.

NEW MADRID, MO.—The New Madrid Telephone Company has a switchboard capacity of 100 drops and 54 subscribers, and a prospective increase of 100 more. The outlook is very favorable. John N. Long is manager.

ST. LOUIS, MO.—The Kinloch Telephone Company has been authorized to place poles on the streets in Venice and will begin work at once. The company has also secured a frenchise from the other towns on the east side.

REPUBLIC, MO.—The Republic Telephone Company reports business improving steadily. Mr. G. G. Youngblood informs us that, with a switchboard of 24 drops, it has 17 subscribers and 7 toll lines. More toll lines are also being built.

SHELBINA, MO.—The Shelby County Telephone Company has a switchboard capacity of 250 drops, 75 country lines and others projected. There are 300 subscribers, 25 of whom are new. Mr. J. M. McCully, the manager, states that the prospects are good.

MOBERLY, MO.—The Moberly Telephone Company informs us, through Mr. Pickert, its superintendent, that prospects are extremely bright. Its switchboard capacity is 300 drops, and, of 270 subscribers, 70 have joined in the last 90 days. Fifty new contracts are now on hand.

ST. LOUIS, MO.—The injunction suit of the Kinloch Telephone Company against the Seckner Contracting Company, to restrain the latter from stringing wires on poles belonging to the Kinloch Company was dismissed last week, the companies having reached a mutual agreement.

SENECA, MO.—Mr. Berry, of the Seneca Telephone Company, informs us of its rapid growth. It has a 100-drop board and 80 subscribers, with 34 miles of toll line. The company was started little more than a year ago for the convenience of a few citizens, but has increased beyond all anticipations.

CASSVILLE, MO.—The Barry County Telephone Company, with toll stations at several other towns, has a drop-board capacity of 100 here and 300 at Monell; 245 subscribers at the last named place and 55 at this. Mr. Mitchell, the manager, informs us that it will have an entire metallic system in a short time, and will establish several more exchanges and toll lines.

BROWNING, MO.—The Browning Telephone Exchange, 100-drop switchboard capacity, has 384 subscribers. Two new lines with 20 subscribers are of recent growth. The exchange is organized and operated on the mutual plan. Each subscriber buys one share, builds his own line, buys his telephone and shares equally in the payment of operating expenses. All tolls collected from non-members go into the general fund toward expenses.

NEBRASKA.

KEARNEY, NEB.—The Kearney Northwestern Telephone Company has a toll line of about 160 miles and 50 telephones.

VALLEY CITY, NEB.—The Valley City Telephone Exchange contemplates several country lines, has a 200-drop switchboard and 218 subscribers, with good prospects.

PLATTSMOUTH, NEB.—The Western Independent Long-Distance Telephone Company has a first-class business and outlook. With drop-board capacity of 400, it has 380 subscribers and an increasing list.

KEARNEY, NEB.—We are informed, through Manager S. H. Evans, of the Home Telephone Company, that its switchboard capacity has 300 drops, that it has 230 subscribers, 90 recently acquired, and that a large increase is expected.

GOTHENBURG, NEB.—The Gothenburg Telephone Exchange has a favorable future outlook. Mr. Lloyd informs us that there is a great demand for extensions, and it already has 25 miles of toll line. With 100-drop-board capacity it has a subscription list of 80, which is steadily increasing.

FALLS CITY, NEB.—Mr. A. E. Gantt, secretary of the Falls City Telephone Company, sends us some interesting particulars of an extended telephone line. Its switchboard capacity is 160 and 25 and 30 drops, with 195 subscribers. It operates three exchanges and 70 miles of toll line, connects with the Stella Telephone Company's toll lines, which again connects with the Auburn Company's toll lines, and that in turn connects with the Nebraska City line, which again makes further connections, making 300 miles of independent toll lines in Southeastern Nebraska, with 14 or 15 exchanges.

NEW HAMPSHIRE.

EXETER, N. H.—The Exeter Telephone Exchange has connection with several towns and a good outlook. It operates a 50-drop board and has 43 subscribers. Mr. G. B. Shaw is superintendent.

NEW JERSEY.

MT. HOLLY, N. J.—The Burlington County Telephone Company has 400-drop-board capacity and 300 subscribers. The outlook is very good.

PRINCETON, N. J.—The Automatic Telephone Exchange has just completed extensions which will double its capacity. At present that is 100 drops and 92 subscribers.

TUCKERTON, N. J.—The Atlantic, Burlington & Ocean Telephone Company, through Mr. S. Berlman, its secretary, informs us that its prospects are good. It has a 50-drop switchboard and 25 subscribers.

BRIDGETON, N. J.—The Bridgeton Telephone Company finds business taxing its resources, and its prospects are bright. Its switchboard capacity is 200 drops, 170 drops being in use; 206 telephones and 230 subscribers.

PATERSON, N. J.—We learn from Mr. Lindsay, of the Paterson, Passaic & Suburban Telephone Company, that business is good. Its drop-board capacity is 1700 in Paterson, 300 in Passaic. Total number of subscribers, 1100.

POINT PLEASANT, N. J.—The Seashore Telephone Company has a total drop capacity of 130, and 120 subscribers. Recent growth and outlook are very good, and a new building is to be erected. J. W. Johnson is secretary.

BELVIDERE, N. J.—The West Jersey Toll Line covers Warren County and has 100 subscribers, although its switchboard capacity is only 50. It recently made connections with the New Jersey & Pennsylvania Telephone Company, of Easton, Pa., and with the Slate Belt Telephone Company. Among the projected improvements is a connection with the Sussex Telephone Company. Mr. G. W. Cummins, secretary, states that the prospects are very good for doubling both his company's toll line work and number of subscribers. The company now has access to 800 telephones in two counties in New Jersey and Pennsylvania, and expects to soon have connections with Port Jervis, N. Y., and Allentown, Pa., and beyond.

NEW MEXICO.

CARLSBAD, N. M.—The Pecos Irrigation & Improvement Company has but a small system for the use of its employees. An independent system is being put in at this place.

NEW YORK.

SAUGATUCK, N. Y.—The Saugatuck Telephone Company has 180 subscribers and its business is fairly good.

NEW YORK, N. Y.—The Knickerbocker Telephone & Telegraph Company is now constructing its plant in this city.

OSWEGO, N. Y.—The Ontario Telephone Company has a board capacity of 500 drops, and 435 subscribers. Its business is rapidly increasing.

ONEIDA, N. Y.—The Oneida Telephone Company has toll connections with 87 points. Switchboard capacity, automatic, 100 switches; 73 subscribers.

PORT JERVIS, N. Y.—The Port Jervis Telephone Company now has 325 subscribers, after being in the field for two years. L. D. Bennett is manager.

SIDNEY, N. Y.—The Union Telephone Company has switchboard capacity as follows: Sidney, 80 drops; Amadilla, 60; Bainbridge, 40. Subscribers, 148.

ALBION, N. Y.—Mr. G. A. Bowen, of the Citizens' Telephone Company, says that prospects are fine. With 200-switchboard capacity it has 108 subscribers.

STAMFORD, N. Y.—We learn from Mr. Hubbell, president of the Stamford Telephone Exchange, that business is prosperous. With a 100-drop capacity it has 60 subscribers.

MIDDLEBURGH, N. Y.—Mr. Best, president of the Middleburgh Telephone Company, informs us that the whole system is being improved. It has at present a 100-drop board and 40 subscribers.

FULTON, N. Y.—The Fulton Telephone Company, Mr. Webb, manager, reports excellent business, all in 18 months. It has a 200-drop board, 150 subscribers and 100 additional are in prospect.

GREENFIELD, N. Y.—The Greenfield Telephone Company has been incorporated; capital $1000; directors—C. E. Latham and Henry Menshausen, Porter's Corners, and B. S. Robinson, Greenfield Centre.

LITTLE VALLEY, N. Y.—The Little Valley Telephone Company is building 6 miles of line into the farming districts. Its business has had a steady growth and the prospects are good. Mr. E. L. Campbell is manager.

LOCKPORT, N. Y.—The Crosby Telephone Line is a toll line 15 miles long, connecting five villages. The line has been extended 6 miles recently and another 6-mile extension is projected. Mr. E. B. Crosby is manager.

CAZENOVIA, N. Y.—Mr. D. H. Fitch, manager of the Cazenovia Telephone Company, reports a gradual increase in new stations, and that it has 99 subscribers, with drop-board capacity of 35. The prospects are very good.

ROME, N. Y.—The Rome Home Telephone Company has a switchboard capacity of 1500 drops and uses 700. There are 350 subscribers. Mr. Bailey informs us that it has 100 miles of metallic toll line, reaching over 100 stations.

NEWARK, N. Y.—Mr. W. H. Kelley, owner and manager of the Newark Telephone Exchange, reports good business and a steady increase. He has a 200-drop switchboard and 140 subscribers. He proposes building a 6-mile trunk line.

SOUTH SCHENECTADY, N. Y.—During the past summer the Mariaville & South Schenectady Telephone Company built a line between Mariaville and South Schenectady. It is expected that the line will be extended. C. A. Cullings is secretary.

SHERMAN, N. Y.—We are informed, through Mr. H. H. Corbett, of the Sherman Telephone Company, that it has just completed toll lines which put it in communication with over 2000 independent telephones. It has a 50-drop board and 75 subscribers.

FAR ROCKAWAY, L. I., N. Y.—The work of building conduits and laying the wires of the New York & New Jersey Telephone Company under ground was commenced recently, and the company will push the work as fast as possible to completion.

GRANVILLE, N. Y.—Mr. Hicks, manager of the Granville Telephone Company, sends the following information: Switchboard capacity, 100 drops, with 500 subscribers. Forty miles of new line have been built this year and numerous improvements are projected.

WALTON, N. Y.—The Walton Telephone Company has a board capacity of 150 drops and 155 subscribers. During the past year it has increased the number of subscribers by 25. It will build several toll lines into the farming regions, which is a very promising business.

WARRENSBURGH, N. Y.—This exchange is owned by Mr. R. E. Rooney. The title is the Warrensburgh Telephone Exchange. Mr. Rooney informs us that its switchboard capacity is 50 drops and that it has 75 subscribers. It expects a 50 per cent increase next year.

CHESTERTOWN, N. Y.—The Chestertown Telephone Company started business on June 1, 1899, with 25 subscribers. The number has since increased to 65. Its lines will probably be extended to Glens Falls, as there is need for such a connection. The business outlook is good.

WATERVILLE, N. Y.—The Waterville Telephone Company's switchboard capacity is: Waterville, 200 drops; Deansboro, 25; Oriskany Falls, 25. Subscribers, 150, 12, 15. Connections with Rome Telephone Company (150 towns). Increase projected to Buffalo and Binghamton.

DOLGEVILLE, N. Y.—Mr. H. I. Patrie, who is the receiver of the Dolgeville Telephone Company, informs us that it has a 125-drop board and 60 subscribers. A projected connection with Herkimer and other towns is contemplated. There has been a decided increase in business from former extensions.

MALONE, N. Y.—The Franklin County Telephone Company is doing a good business and growing in a very satisfactory manner in spite of the "free" service of the Bell Company. On Oct. 1 it had 160 subscribers, an increase of 55 during the year previous. The present board capacity is 100 drops, but a 200-drop board, in a 300-case, is to be installed. Mr. C. P. Richey is the manager.

ALBANY, N. Y.—The West Canada Telephone Company was incorporated with a capital of $3,000, to operate a telephone system connecting Trenton Falls, Grant, Wilmurt and Nobleboro, Herkimer County; Morehouseville, Poceco, Lakes Hamilton and Lakes Wilmurt, Morehouse, Sheriff, Grand Pine and Poland. The directors are Jonah W. Jenkins, James E. Jenkins, of Vernon; S. E. Harvey, of Grant; Byron E. Turnbull, of Utica, Charles H. Clark, of Canastota; Walter W. Martin, of Vernon, and John Frinkle, of Ohio.

LOCKPORT, N. Y.—The Home Telephone Company, of Lockport, N. Y., has begun work on its pole line for an exchange in this city. About 20 car-loads of cedar poles have arrived and will be rapidly set throughout the city. The service will be a copper metallic one, with no party lines. It will compete with the Bell Company, which has many ground and party lines still in use here. The local company will also build a toll line to Niagara Falls and Tonawanda, to connect with the local independent exchanges already in operation there. The new company is being cordially indorsed by the public.

FULTONVILLE, N. Y.—The Glen Telephone Company is installing systems in Johnstown and Gloversville, putting in a 500-drop board at Johnstown, where there are 300 subscribers. It will have 500 subscribers in Gloversville. Connections will be made with near-by villages and with independent companies. President J. S. G. Edwards reports that his company now has 50 per cent more subscribers than the old company has. The company has laid 80,000 ft. of electrical subway in Johnstown, and purchased a brick building for an exchange.

ROCHESTER, N. Y.—The Rochester Telephone Company opened its exchange on May 15 with 2000 connections and now has 3570, gaining 1000 in the last four months. It is looking forward to a further increase of 1000. It has a board capacity of 3600 and the limit has been almost reached. Mr. C. O. Harris, superintendent of construction, reports that the company is getting subscribers faster than it can get them connected. The company has installed 200,000 ft. of underground cable and has placed orders for 59,000 ft. more. It has 160 miles of toll lines and 43 toll stations connected. All the toll lines are built to standard specifications, and are being extended in all directions.

NORTH CAROLINA.

BURLINGTON, N. C.—T. J. McAdoo has purchased the telephone exchange here and is completely reconstructing the system.

LENOIR, N. C.—The Lenoir Telephone Company reports business very good. With a 65-drop-board capacity it has 69 subscribers and an expected increase.

REIDSVILLE, N. C.—The Reidsville Telephone Company has a 144-drop board and 125 subscribers. Mr. Oliver reports steady advance and good prospects.

SCOTLAND NECK, N. C.—The Carolina Telegraph & Telephone Company has a promising outlook. The switchboard has a capacity of 125 drops, with 68 subscribers.

CHARLOTTE, N. C.—J. B. Steel and A. E. Springs are organizing the Georgetown & North Island Telephone Company in South Carolina. The capital stock is placed at $1,000.

ANDOVER, N. C.—The Andover Electric Telephone Company, has been incorporated. Capital, $6,000. Incorporators: C. E. Harmon, S. R. Wood, W. Grubham, V. M. Cole and W. Webb.

GREENSBORO, N. C.—The Greensboro Telephone Exchange has a switchboard capacity of 500 drops at Greensboro and 200 at Burlington, N. C. Business being very prosperous in this section, the company expects to have 700 at both places during the next year.

HENDERSON, N. C.—The Carolina & Virginia Telephone Company has recently built a new copper metallic line from Rocky Mount to Louisburg, a distance of 40 miles. It has rebuilt its exchanges at Rocky Mount and Greenville, increasing the capacity of the former from 150 to 180, and of the latter from 90 to 130. It is now building a metallic line from Oxford to Chase City, and exchanges at Clarksville and Boydton, Va. The business outlook is good.

NORTH DAKOTA.

DEVIL'S LAKE, N. DAK.—Mr. A. Tompkins informs us that he operates a 200-drop switchboard and has 185 subscribers, with a fair future outlook.

JAMESTOWN, N. DAK.—The Northwestern Telephone Company has established long-distance stations at Rogers, Hannaford, Dazey and Cooperstown. The wires have been strung from Sanborn to Cooperstown.

DEADWOOD, N. DAK.—The Harrison Telephone Company, Mr. G. W. Cornwell, general manager, operates a 600-drop board, has 500 subscribers and projects an increase of as many more. The outlook is excellent.

HARVEY, N. DAK.—The North Dakota Telephone & Electrical Company has three switchboards of 50 numbers each, and 120 subscribers. Mr. C. L. King, the president, states it will probably make large extensions in the near future.

OHIO.

CLEVELAND, OHIO.—The United States Telephone Company has commenced work on a long distance line from Toledo to Saginaw, Mich.

NEW CONCORD, OHIO.—The New Concord Telephone Company, recently opened, has 100-drop-board capacity, 59 subscribers and good prospects.

CAREY, OHIO.—The Carey Electric Telephone Company reports bright prospects. It has a 125-drop board and the same number of subscribers.

DOYLESTOWN, OHIO.—The Doylestown Telephone Company expects to increase the number of its subscribers to 100 by June, 1901. It now has 70.

LEWISBURG, OHIO.—Mr. R. M. Gay, secretary of the Lewisburg Telephone Company, thinks prospects good. There are 20 subscribers and a 50-drop switchboard.

ASHTABULA, OHIO.—The Ashtabula Telephone Company, Mr. S. M. Strong, manager, has a capacity of 700 drops, and 690 subscribers. The outlook is very birght.

YOUNGSTOWN, OHIO.—The Youngstown Telephone Company has an 1800-drop capacity, and 1100 subscribers, 400 of which were added recently. Prospects are good.

KENTON, OHIO.—The Kenton Telephone Company is a thriving concern. It has a switchboard capacity of 500 drops, and 420 subscribers, with considerable expected increase.

SALEM, OHIO.—The Columbiana County Telephone Company is building four toll lines from this place to Alliance to connect with the new exchange being established in that city.

CALDWELL, OHIO.—The toll lines running east from this place, heretofore owned by the Zanesville Telephone Company, have been sold to the Caldwell Independent Telephone Company.

BEREA, OHIO.—The Citizens' Telephone Company, of this place, has been granted a franchise by the county commissioners to extend its wires to the county line on the way to Medina.

GARRETTSVILLE, OHIO.—Mr. F. B. Hopkins, proprietor of the Garrettsville Telephone Exchange, proposes building a farmers' line. He is now putting in a 200-drop board and has 115 subscribers.

ELYRIA, OHIO.—Mr. Frankford, manager of the Elyria Telephone Company, reports an increase of 300 subscribers in 18 months, making a total of 732, with an 800-drop board. Prospects are bright.

LORAIN, OHIO.—The Black River Telephone Company is prospering. It has a 600-drop board and 553 subscribers, 323 of whom have recently joined. It will soon decide on a large increase to meet demands.

CANAL DOVER, OHIO.—The Canal Dover Home Telephone Company has commenced business with a switchboard capacity of 300 drops and 230 subscribers. Toll lines in several directions are proposed.

GALION, OHIO.—The United States Telephone Company, of Cleveland, has commenced work on three long-distance circuits from this place to Columbus, to connect the exchanges in Mt. Gilead, Cardington and Delaware.

TOLEDO, OHIO.—The Ottawa County Telephone Company has been incorporated with $30,000 capital, has an exchange at Oak Harbor and others being built at Elmore, Woodville and Genoa. It has 40 miles of toll line.

VAN WERT, OHIO.—The Van Wert Home Telephone Company increased the number of subscribers last year by 230. It now has 430, with a switchboard capacity of 500. An increase to 700 is projected. Mr. J. Van Liew is secretary.

WOODSFIELD, OHIO.—The Woodsfield Telephone Company has 400 subscribers and drop-board capacity of 150. With 150 miles of toll line, 50 miles more will be added, the development of the oil fields imparting a fresh business stimulus.

MADISON, OHIO.—We are informed by the secretary of the Co-Operative Telephone Company, of Madison, Ohio, that it expects to double present equipment. Its number of drops is 200, subscribers 150 and it has recently added 50 miles of line, with 20 subscribers.

SIDNEY, OHIO.—From the Sidney Telephone Company, through Manager Dickinsheets, we hear very flattering reports. Beginning operations Jan. 1, 1900, with 185 subscribers, it now numbers 440 and has a 450-switchboard capacity, with 10 miles of toll lines.

ALLIANCE, OHIO.—The city solicitor has begun suit to enjoin the Columbian County Telephone Company and the United States Telephone Company from installing their systems in this place, on the ground that the ordinances granted the companies were illegal.

EAST LIVERPOOL, OHIO.—The Columbiana County Telephone Company began business in May of this year and now has 479 subscribers. It has a switchboard capacity of 600 lines, and expects to double its present business. Mr. W. R. Montgomery is manager.

IRONTON, OHIO.—The Lawrence Telephone Company has good prospects and proposes laying cable in the city. The recent growth has been rapid, and, with a 600-drop board it has 500 subscribers. We are indebted to the president, Mr. W. B. Seaton, for this information.

ALLIANCE, OHIO.—If the Columbiana County Telephone Company is defeated in the suit brought against it by the city solicitor in an effort to revoke the franchise, an application for a new franchise will be made. Local business men are anxious to have the line placed in operation.

RAVENNA, OHIO.—The Ravenna Home Telephone Company now has 250 subscribers. It started April 1, this year, with 90, and expects to have 350 within a year. This is a business men's organization, with 45 stockholders. President H. L. Beatty reports that the merchants of Ravenna have generally abandoned the Bell service in order to patronize the home company exclusivly.

MANSFIELD, OHIO.—A. R. Warner, of Cleveland, representing the United States Telephone Company, is said to have secured the franchise for an independent exchange owned by the Citizens Telephone Company which ceased operations some time ago. The company had contracts for 1200 telephones when it went out of business. The new system will be built at once.

CLEVELAND, OHIO.—The value of the property of the telephone companies operating in Cuyahoga County is $1,488,938 according to reports received by the county auditor from the State Board of Equalization. The value of the real estate owned by the companies is not included. The Cleveland Telephone Company has 14,438 miles of wire valued at $409,115; other property valued at $564,849; total $974,000. Cuyahoga Telephone Company, 18,608 miles of wire valued at $465,000. United States Telephone Company, 252 miles wire valued at $14,195. Ohio Telephone & Telegraph Company, 1050 miles wire valued at $32,567; other property, $776; total, $33,343. Chagrin Falls Telephone Company, 28 miles wire valued at $1400. Citizens Telephone Company, Berea, 50 miles wire valued at $5000.

CLEVELAND, OHIO.—The United States Telephone Company is making every effort to complete projected long distance lines in this State and Michigan before snow flies. Reports made to General Manager Thomas last week show that construction superintendents with crews are at work as follows: O. T. Barr, North Baltimore, Ohio; H. S. Putnam, Celina, Ohio; Charles Phillians, Kimball, Ohio; P. M. Thayer, Alliance, Ohio; E. S. Ellis, Galion Ohio; James Stringfellow, New Comerstown, Ohio; C. N. Lukenbill, Newark, Ohio; John A. McDowell, Coshocton, Ohio; C. H. McCullough, Zanesville, Ohio; V. H. Calhoun, Cuyahoga Falls, Ohio; J. Cummings, Lainsburg, Mich.; George Bracht, Oakley, Mich. A through line from Cleveland to Zanesville connecting a large number of exchanges will shortly be placed in operation.

COLUMBUS, OHIO.—State Auditor Guilbert, of Ohio, has just announced the valuations of telephone properties in this State as returned by the State Board of Appraisers and Assessors. There is a general increase on the 114 different properties of this kind in the State. Among the larger companies the Central Union Telephone Company was raised from $1,127,584 in 1899 to $1,853,476 in 1900; the Cleveland Telephone Company from $708,022 to $1,064,986; the City & Suburban (Cincinnati), from $673,438 to $743,179; the United States Telephone Company from $41,960 to $325,986; the Cuyahoga Telephone Company from $224,000 to $505,000; the Central District Printing & Telegraph Company from $167,637 to $264,537. The returns were as follows: Ada Telephone Company, $3,264; Ashtabula, $15,531; Barnesville & Woodsford, $1,000; Bellefontaine, $8,854; Bellevue, $253; Blode River, $20,025; Bluffton, $3,900; Bryan, $5,000; Bucyrus, $9,540; Burton, $12,100; Bartlett & Monieta, $664; Bowling Green, $9,000; Cowlindge Home, $5,639; Coxey Electric, $1,800; Caldwell, $5,000; Celina, $2,310; Central District Printing & Telegraph, $264,537; Central Union, $1,853,476; Gallipolis, $700; Graysville, $99; Greenfield Mutual, $6,608; Hamilton Heights & Monroe, $2,360; Hicksville, $1,710; Chillicothe Home, $19,000; Plain City Home, $3,507; Pincher Home, $105; Tiffin Home, $10,500; Huron County, $5,422; Inland & Bloomfield, $2,268; Inland & Knoxville, $2,625; Jefferson & Warren, $9,760; Kenton, $8,100; Lawrence, $10,800; Lima, $10,120; London, $3,892; Madison, $5,625; Manchester, Bentonville & West Union, $190; Marysville, $1,875; Mechanicsburg, $1,904; Medina, $7,500; Miami, $27,510; Millersburg, Wooster & Orville, $14,000; Montpelier, $1,800; Morrow County, $3,456; Mt. Vernon, $8,627; Mt. Vernon (Gambier), $500; National Telephone & Telegraph, $1,335; Newark, $10,115; Chagrin Falls, $1,400; Chardon, $4,455; Chillicothe & McArthur, $4,200; City & Suburban, $743,179; Citizens' West Unity, $780; Citizens', Berea, $5,000; Citizens', Coshocton, $7,026; Citizens,' Delaware, $5,200; Citizens' Telephone & Message Company, $7,800; Citizens', Washington Court House, $8,000; Carroll County, $2,987; Cleveland, $1,066,896; Clyde, $2,275; Clinton, $5,600; Columbiana County, $60,834; Conneaut, $9,000; Coppers, $2,700; Cuyahoga, $505,000; Delphos Home, $3,000; Doyleston, $650; Eastern Ohio, $3,023; Eaton, $4,480; Elyria, $13,000; Elyria Southern, $3,600; Farmers', $6,776; Farmers & Merchants', $2,800; Farmers' Co-Operation, $1,600; Flat Rock, $315; Flushing, $315; Galion, $3,750; New Bremen, $1,050; New Harrison, $18,000; Newton Falls, $160; Norwalk, $5,110; North Amherst, $1,875; Northern Ohio, $3,150; Northwestern, $5,000; Northwestern Ohio, $2,780; Oak Harbor, $2,100; Oberlin, $2,675; Ohio Telephone Construction Company, $541,781; Painesville, $7,200; Paulding Home, $1,200; Preble, $140; People's Butler, $760; Piqua Home, $5,530; Port Clinton, $4,050; Progress Telephone &

Telegraph, $1,380; Putnam, $7,112; People's Shelby, $3,750; St. Paris, $1,400; Sandusky, $18,000; Sayers, $200; Sharon, $300; Sydney, $400; Sidwell & Miller, $70; Star, $14,550; St. Mary's, $4,000; State Line, $1,802; United States (Cleveland), $324,897; United States (New Lexington), $1,380; Upper Sandusky, $3,600; Urbana, $11,680; Valley, $2,632; Van Wert, $3,256; Wadsworth General Electric, $1,200; Wapakoneta, $2,100; Warren & Niles, $1,907; Waterford, Wolestown & Vincent, $300; Wellington, $2,250; Williams County, $3,300; Youngstown, $61,800; Zanesville Telephone & Telegraph, $11,001; Kent Home, $2,100; Napoleon Telephone Company, 1897, $3,600; 1898, $5,000; 1899, $5,000; 1900, $6,350; Napilent Oil Line, 1898, $3,612; 1899, $3,612; 1900, $5,292. The last two companies failed to report and were charged back taxes.

OKLAHOMA.

ALVA, OKLA.—The Alva Telephone Exchange intends putting in a new switchboard. The present capacity is 100 drops.

KINGFISHER, OKLA.—The Kingfisher Telephone Exchange is prospering. Mr. Steele informs us that it has done good work since 1898 and now has 200-drop-board capacity and 178 subscribers.

PONCA CITY, OKLA.—The manager of the Northern Oklahoma Telephone Company informs us that it operates a 110-drop board and intends putting in a new one with increased capacity. It has 105 subscribers.

BLACKWELL, OKLA.—The general manager of the Northern Oklahoma Telephone Company, Mr. E. A. Hildebrand, informs us that present business is prosperous and the outlook bright. It operates a 105-drop board here, and one of 100 at Newkirk, with 100 and 50 subscribers, respectively. A 200-drop board is projected.

PENNSYLVANIA.

PAULSBORO, PA.—A new telephone exchange is being established at this place.

EMPORIUM, PA.—The Emporium Telephone Exchange is in good shape and has been adding steadily to its subscription list.

NEW BETHLEHEM, PA.—Mr. E. V. Marsh, secretary of the Millville Telephone Company, informs us that it has a switchboard capacity of 100, and 40 subscribers.

BALDMOUNT, PA.—The Newton, Ransom & Lake Winola Telephone Company has 50 subscribers, mostly farmers, using extension bells. It is now building new lines.

INDIANA, PA.—The Indiana Telephone Company has increased the number of subscribers 53 since Jan. 1. It now has 375 subscribers and an exchange capacity of 390 lines.

CARNOT, PA.—The Carnot Telephone Company has been incorporated. Capital, $1,000. Incorporators: G. O. Somerville, E. P. Averill, C. A. Dally and J. A. Shaffer, all of Carnot; M. H. Stevenson, of Pittsburg.

CHERRY FLATS, PA.—Mr. Richards, the secretary of the Farmers' Mutual Telephone Company, reports that it will extend its lines considerably in its own, and probably in other counties. It has about 200 subscribers.

NAZARETH, PA.—The Slate Belt Telephone & Telegraph Company has a capacity of 500 drops and 300 subscribers, 100 gained during the last year. Mr. Williams, the treasurer, informs us that the outlook is very bright.

APOLLO, PA.—The Apollo Local Telephone Exchange will double its present capacity. It has now 125 subscribers, with an exchange capacity of 150 drops. It has grown rapidly this summer. Chas. W. Bollinger is proprietor.

TUNKHANNOCK, PA.—The Wyoming Telephone Company reports, through its secretary, Mr. Kiemer, that the outlook is good. Extensions have been made and more are projected. Its present switchboard capacity is 100 drops, with 60 subscribers.

WEST CHESTER, PA.—Mr. Hoopes, manager of the Chester County Telegraph & Telephone Company, reports an excellent outlook. It operates a switchboard of 630 drops, 1200 ultimate capacity, and has 550 subscribers. It contemplates building several small branches.

ASHLAND, PA.—Mr. Price, secretary of the Schuylkill Telephone Company, informs us that it has nearly 1000 subscribers. It has connected with Centralia, Shenandoah, Mahanoy City, Ringtown, Gerardville, Gordon and Pottsville. Other towns will also be connected at an early date.

STROUDSBURG, PA.—The Stroudsburg & Bushkill Telephone Company reports a fine outlook. Drop-board capacity, 200; subscribers, 174. Mr. Hursh informs us that, under new management, the company is improving rapidly. It connects with other companies to the number of 1000 telephones.

CHAMBERSBURG, PA.—The superintendent of the Cumberland Valley Telephone & Telegraph Company, Mr. D. L. Gove, informs us that they have purchased and consolidated the Franklin & Fulton Telephone Company, and are now building 15 miles of additional toll line. Switchboard capacity, 1100 drops; number of subscribers, 1000. It is adding 8 to 10 telephones each week.

SOUTH CAROLINA.

NINETY-SIX, S. C.—The Ninety-Six Telephone Company has only 20 subscribers, but the business outlook is so good that a larger switchboard is in contemplation.

SALUDA, S. C.—We are informed by Mr. A. Etheredge, treasurer of the Saluda Land & Improvement Company, that he is building a telephone exchange at Johnston, S. C.

DILLON, S. C.—E. L. Moore, of this place, is interested in the organization of a proposed new telephone company at Fayetteville, N. C. He desires to have 100 subscribers pledged as a guarantee.

GREERS, S. C.—Lewis W. Parker, of this place, and others, embracing most of the independent telephone line owners in South Carolina, have purchased the Citizens' Telephone Exchange at Spartansburg, S. C., for $22,500.

CHARLESTON, S. C.—The Sea Island Telephone Company, of Charleston, has been incorporated. Capital, $10,000. Incorporators: F. W. Towles, H. Plitch, W. C Jenkins, C. B. Garity, E. M. Seabrook and C. M. Gibson.

CHESTER, S. C.—Manager F. M. Boyd, of the Chester Telephone Company, informs us that it contemplates putting in a new board, and is getting 10 new subscribers. At present there are 175, and it has a 200-drop switchboard.

GREENVILLE, S. C.—The Home Telephone Company has a 400-drop board and 560 subscribers, many of recent date. The future is very promising. This company has been sold to the Consolidated Telephone Company of South Carolina.

CHARLESTON, S. C.—The Gordon Telephone Company, established in Charleston three years ago, has decided to enter larger fields. It is understood that connections will be made with the independent concerns in this State and thus be able to cover a large field.

SOUTH DAKOTA.

TERRY, S. D.—The Harrison Telephone Company has a branch office at this place, with a 50-drop board and 35 subscribers.

CANTON, S. D.—Mr. Bacon, the secretary of the Canton Co-Operative Telephone Company, thinks the outlook excellent. It has 167 subscribers, with steady increase in number. It proposes laying a cable next spring.

TENNESSEE.

SHELBYVILLE, TENN.—J. H. Hutton and others are organizing an independent telephone company.

TAZEWELL, TENN.—The Sunrise Telephone Company has a 100-drop switchboard capacity and contemplates a few short lines.

CLEVELAND, TENN.—The Cleveland Telephone Company looks to the future hopefully, with 85 subscribers and an exchange of 100 drops.

SWEETWATER, TENN.—Manager Smith, of the Telephone Improvement Company, reports a good outlook and 55 subscribers. It has a 100-drop switchboard.

CROSSVILLE, TENN.—The Gainesboro Telephone Company is putting in a copper wire to Rockwood and making other improvements that will better its service.

McMINNVILLE, TENN.—The McMinnville Telephone Company has 69 miles of toll line, switchboard of 100-drop capacity, 120 subscribers, and a prosperous outlook.

BRISTOL, TENN.—During this year the number of subscribers of the Bristol Telephone Company was increased 145. The total number now is 415, while the switchboard capacity is 500.

KNOXVILLE, TENN.—The manager of the People's Telephone & Telegraph Company reports very favorably. It has a 900-drop board, 900 subscribers and a large increase is expected in the near future.

DICKSON, TENN.—The Cumberland Telephone Company has shown great activity. From June, 1899, there has been a steady increase of subscribers, which now number 97. The switchboard capacity is 100 drops.

MARTIN, TENN.—Mr. Martin, the secretary of the Weakley County Telephone Company, informs us that it has made connections with several neighboring county towns, and intends branching out to others. It has a 200-drop board and 196 subscribers.

ERIN, TENN.—The Houston County Telephone Company has only recently been formed, and the manager, Mr. Cooley, finds business better than he anticipated. It has a 50-drop board, but expects to put in a larger one and make improvements and extensions. There are at present 45 subscribers.

COLUMBIA, TENN.—We are indebted to Mr. O. J. Porter for the following concerning the Citizens' Telephone Company, which had 70 subscribers in 1897, 250 in 1898, and 308 in 1899; the number is now 410, and a new "central energy" exchange is projected. Present switchboard capacity is 500.

CHATTANOOGA, TENN.—President James E. Caldwell, of the Cumberland Telephone Company, announces that the purchase of the entire East Tennessee Telephone System by the Cumberland Company has been consummated and that the plans are now being made for extensive improvement of the combined property.

TEXAS.

NAVASOTA, TEX.—W. H. Freeman of Rosebud, Tex., is interested in a project to install a telephone system here.

DENTON, TEX.—The Denton Telephone Company has 121 subscribers and a daily increasing list. Switchboard capacity, 150 drops.

BONHAM, TEX.—The Bonham Telephone Company has a 200-drop board and 180 subscribers. The growth has been rapid and the outlook promises a continuance of the same.

PITTSBURG, TEX.—The C. V. Weir Telephone Company has a 200-drop board, but will soon install one of 300 drops. There are at present 150 subscribers, but a large addition is expected.

BIG SPRINGS, TEX.—Manager J. S. Roberts, of the Big Springs Telephone Company, informs us it commenced operations January, 1900, and has made steady advance since. It has a 100-drop board and 85 subscribers.

PALATINE, TEX.—We are glad to note the enterprise of the Palatine Telephone Company. With a 500-drop board it has 400 subscribers and a daily increasing list. New boards, new telephones and new management are contemplated.

HUNTSVILLE, TEX.—We are indebted to Mr. Robinson, of the Huntsville Telephone Company, for the subjoined information. The company finds it difficult to keep up with orders. It operates a 200-capacity switchboard and has 150 subscribers.

VERMONT.

BRANDON, VT.—Mr. Chandler, of the People's Telephone Exchange, sends us a favorable report. Its drop-board capacity is 30, while its subscribers number 145.

BARTON LANDING, VT.—The Vermont People's Telephone Company, Mr. D. Buchanan manager, is a flourishing corporation with a bright outlook. It has recently built 50 miles of line and gained 100 subscribers. The entire number is 350, and it operates 6 switchboards.

ENOSBURG FALLS, VT.—The Northern Telephone Company, with exchanges at Swanton and Richford, announces favorable prospects, through Manager Ovitt. It has 3 switchboards of 50 drops each, and 185 subscribers. An 18-mile trunk line is to be built within a month.

VERGENNES, VT.—The Addison & Panton Telephone Company, which started business last May with 30 subscribers, will build 30 miles of new line. It will connect Vergennes, Addison, Panton and Bridport. Mr. F. E. Sears is president. He reports the outlook good for independent companies.

VIRGINIA.

FALLS CHURCH, VA.—The Falls Church Telephone & Telegraph Company has a 100-drop board and 25 subscribers, with expected increase. Prospects are good.

BLAND, VA.—The Bland Telephone Company is now putting in a switchboard. Mr. Newberry, the manager, is now getting things into shape to commence operations.

NEWPORT NEWS, VA.—The Newport News & Richmond Telephone & Telegraph Company, a new undertaking, has a promising outlook. It has a 100-drop switchboard and 50 subscribers.

ELIZABETH CITY, VA.—The Hampton Telephone Company has a 300-drop switchboard and proposes putting in an additional one by 1901. It has 287 subscribers and a very good outlook.

FARMVILLE, VA.—The Farmville Telephone Company notes a rapid increase of subscribers, of whom there are 147, with a 200-drop switchboard. It has connections with four nearby towns.

WOODSTOCK, VA.—The Shenandoah County Telephone Company has a switchboard capacity of 140 drops and 100 subscribers. Prospects for the future are bright. The secretary is J. H. Grubill.

SUFFOLK, VA.—The owner of the Nansemond Telephone & Telegraph Company, Mr. McAnge, mentions a proposed increase of toll lines. With a 200-drop board it has 175 subscribers and an increasing list.

PULASKI, VA.—The Virginia & Tennessee Telephone Company operates 12 switchboards and has 1200 subscribers. Mr. Langhorn, the manager, informs us that it has just completed 150 miles of metallic copper trunk line.

GLOUCESTER COURT HOUSE, VA.—The Tidewater Telephone Company, Mr. Catlett, superintendent, reports 110 subscribers. An exchange at Saluda is projected, and many extensions will be finished by the end of the year.

NORFOLK, VA.—The Southern States Telephone Company has a 2000-drop switchboard and 1500 subscribers, with steady increase. Mr. Bonney, the manager, informs us that it contemplates additional cable and line capacity.

STAUNTON, VA.—The president of the Long-Distance Telephone Company of Virginia furnishes an account of its extensive enterprise. Lines are now being constructed to connect all the principal town and cities in the State. Only first-class metallic copper lines are being put in.

CLIFTON FORGE, VA.—The Clifton Forge Mutual Telephone Company informs us, through its manager, Mr. J. A. Sproul, that it has two exchanges, one at Covington, Va., their united capacity being 320 drops. It has 300 subscribers, which number increases steadily, and the outlook is exceedingly promising.

LURAY, VA.—Mr. E. J. Foote, manager of the Page Valley Telephone Company (which was reorganized from the Luray & Sperryville Telephone Company), gives some notes of a very prosperous corporation. With a 100-drop board and 40 subscribers it has in contemplation several new toll lines and has already a fine trunk line to New Market, 15 miles distant.

WASHINGTON.

ELMA, WASH.—A new telephone company is to be organized here, and it is expected that before long a line will be established giving direct communication between Centralia and Hoquiam, taking in Aberdeen, Montesano, Satsop, Elma, Porter, Oakville and Gate City. The promoter of the proposed line and company is O. H. Pearson, of this place.

WEST VIRGINIA.

FAIRMONT, W. VA.—The Fairmont & Mannington Telephone Company has a 500-drop board and 535 subscribers. An installation of overhead cables is projected.

HUTTONSVILLE, W. VA.—The Beverly & Marlinton Telephone Company contemplates building 20 miles of line and has 13 completed. It has a 50-drop board and 50 subscribers.

MOUNDSVILLE, W. VA.—The Panhandle Telephone Company will soon complete connections with the eastern and southern part of the State. Its switchboard capacity is 100, subscribers 16.

ELKINS, W. VA.—The Woodford Telephone Company, Mr. S. C. Woodford secretary and manager, is prosperous. He informs us that it has a drop-board of 900 capacity, 1000 subscribers and a large expected increase.

GRAFTON, W. VA.—The Grafton Telephone Company informs us that it intends putting in a new switchboard and 3500 feet of cable. During three years of existence it has gained 275 subscribers, with 300-drop-board capacity.

WELLSBURG, W. VA.—The Wellsburg Telephone Company, Mr. Cummings, manager, informs us that it intends connecting with long distance and surrounding cities. It has a 200-drop board and 150 subscribers, with fine outlook.

KEYSER, W. VA.—The Union Telephone Exchange reports that its business is growing steadily in the face of severe competition. It has four toll lines and will build more. It has a 100-drop express board in its exchange and 65 subscribers.

HINTON, W. VA.—We are indebted to Mr. J. McCreery for good accounts of the Hinton Consolidated Telephone Company. With a 200-drop board it has 260 subscribers and projects an increase of 100 miles, with probably a raise to 500 subscribers.

PARKERSBURG, W. VA.—The West Virginia Western Telephone Company during the past 12 months increased the number of its subscribers over 400. It now has about 700 subscribers and is extending and improving its toll lines. The business outlook is favorable.

WISCONSIN.

WHITEHALL, WIS.—Mr. O. Rogers informs us that the switchboard capacity of his plant is 70, and that it has 40 subscribers.

LA CROSSE, WIS.—The La Crosse & Southeastern Telephone Company will, this fall, build a 40-mile addition to its system.

PLUM CITY, WIS.—The Union Telephone Company has 70 miles of toll line, with 18 telephones, and announces a very promising outlook.

STEVENS POINT, WIS.—The Common Council granted a franchise for a telephone system to F. A. Southwick, F. L. Dille and F. B. Crocker.

REEDSBURG, WIS.—The Reedsburg Telephone Company has as much work as it can manage, with a drop-board of 200 capacity and 162 subscribers.

ARCADIA, WIS.—The Arcadia Telephone Company, 100-drop switchboard capacity, with 75 subscribers, reports, through Mr. Maurer, that prospects are good.

ALMOND, WIS.—The Almond Telephone Company has established lines to Stevens Point and other places and is extending its business, with very fair prospects.

SHEBOYGAN, WIS.—The Sheboygan County Telephone Exchange has gained 100 subscribers during the past year, and its list now number 600, with a 700-drop switchboard.

NEILLSVILLE, WIS.—The Badger State Telephone Company, Mr. Heath, president, seems in fair condition, with very good prospects. It operates a 150-drop board and has 140 subscribers.

WAUSAU, WIS.—The president of the Wausau Telephone Company informs us that its recent growth has been excellent and its prospects good. It operates a 500-drop switchboard and has 450 subscribers.

PORTAGE, WIS.—The Portage Telephone Company reports a very fair outlook and good business. Its switchboard capacity is 300 drops, and it has 295 subscribers. Eighteen miles of metallic circuit are contemplated.

JANESVILLE, WIS.—The Rock County Telephone Company reports a large increase, having gained 221 subscribers in the last 14 months. The secretary, Mr. R. Valentine, reports a total of 680. Its drop-board capacity is 700.

MONROE, WIS.—The Monroe Telephone Company, installed January, 1900, expects to make improvements before the end of the year. The secretary, Mr. Twining, informs us that its switchboard capacity is 300 drops, that it has 260 subscribers, and that prospects are good.

BERLIN, WIS.—From Mr. A. F. Adams, of the Waushara Telephone Company, we learn of great business activity. It is now rebuilding and enlarging one exchange and erecting another. It has also 100 miles of toll line, and its Berlin switchboard is 200-drop capacity. There are 150 subscribers.

DELEVAN, WIS.—The Walworth County Telephone Company is in its first year, but expects to double operations during the next. Mr. Hackney, the president, informs us that it has a 200-drop board in Delevan and 150 in Elkhorn. Subscribers in the former place number 130; in the latter, 65.

MADISON, WIS.—We are indebted to Mr. J. C. Harber for the following notes of the Dane County Telephone Company, of which he is president. It operates an 1100-drop board and has 1100 subscribers. The increase is about 15 telephones per month. It has a steady growth and a fine outlook.

RACINE, WIS.—The Wisconsin Telephone Company is placing its wires under ground, preparatory to making connections with its new building. The Citizens' Company, composed exclusively of Racine men, will begin putting in the underground work at once. The company claims to have 560 subscribers.

LA CROSSE, WIS.—Mr. Lohmiller, of the La Crosse Telephone Company, reports very satisfying results. Present switchboard capacity is 900 drops, but is to be increased to 2,000. It has 810 subscribers. The company has just completed laying conduits and cable to place all lines in the business district under ground.

GRAND RAPIDS, WIS.—The Wood County Telephone Company, a flourishing corporation, has 275 subscribers at this place and Nekoosa. Within a month lines will be completed forming a connecting link of the whole Wisconsin Valley. This is a co-operative concern, shares being held only by subscribers. We are indebted for the above information to Mr. C. M. Dougherty, general manager, Kibbie, Mich. The Kibbie Telephone Company is mostly rural and is prospering. It operates 6 switchboards of 465-drops capacity, and has about 600 subscribers.

CANADA.

RAT PORTAGE, CAN.—We learn from Mr. J. W. McCrossan that business and prospects are good. The Citizens' Telephone & Electric Company has a 200-drop board and 173 subscribers.

TORONTO, ONT.—A special committee of the City Council has warmly recommended the adoption of an automatic system of telephones and the operation of the systems as a municipal institution. It was said that a great saving could be effected over the prices paid to the Bell Telephone Company. The city engineer calculated that while charging $30 a year for business telephones and $18 for private houses, as against present Bell Telephone charges of $45 and $25, a saving of over $74,000 per annum could still be effected on the whole system. The automatic system which the committee saw in operation at Piqua, Ohio, and which is the invention of a Canadian—Mr. Lorimer, a former citizen of Brantford, Ont.—would still be cheaper, it is claimed. No action, however, has yet been taken by the City Council upon the report of the committee.

MEXICO.

GUADALAJARA, MEX.—The Compania Telefonica Jalisciense, of this city, completed one year of its existence on Oct. 23 and celebrated the event with a grand fiesta and banquet. The company is in a most prosperous condition having extended its lines to Ameca and most of the haciendas in that section. It now has about 250 miles of lines in operation.